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BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

Vol. XXX April, 1959 No. 2

MOVEMENTS OF MICHIGAN HERRING GULLS*

BY W. JOHN SMITH

INTRODUCTION

Since July 1931 Mr. Claud C. Ludwig of 279 Durand Street, East Lansing, Michigan, and his two sons, Dr. Frederick E. and Dr. Claud A. (and sometimes a small crew of helpers), have banded a total of 37,414 juvenile Herring Gulls, *Larus argentatus*, in 17 Michigan colonies. Mr. Ludwig recently has made his carefully kept records of this work available to Dr. George J. Wallace of the Department of Zoology, Michigan State University, for analysis by a student. This report is that analysis. Sincere thanks are due to Mr. Ludwig for supplying these data, and for his patient help in answering my queries about the field work in which I had no part. The nearly 105,000 birds of many species banded by the Ludwig team stand as a truly remarkable tribute to the service these men have done ornithology. To Dr. Wallace I should also like to express my gratitude for his constant advice, suggestions, and careful criticism during both the analysis and literature-search that preceded the writing of this report and the period of writing itself. Dr. P. J. Clark, also of the Department of Zoology, has instructed me on the use of the contingency chi-square method and helped in its application to the data.

The banded gulls have to date yielded some 1,143 recoveries, not including those young birds recovered on or within a few miles of the colonies shortly after being banded. The high mortality of juvenile Herring Gulls still in the colony is too well known to require discussion here; and the inclusion of such recoveries would obviously tell us nothing new concerning the species' life history, but rather would serve only to distort our picture of its movements. These 1,143 recoveries, representing 3.06% of the birds banded, provide a large sample from which has emerged a clear picture of the seasonal distribution of Michigan-born Herring Gulls. Other banding studies of this species in North America and Europe have been published and will be referred to below, along with studies on closely related *Larus* species for comparison.

Location of Colonies

The banding was done in 17 colonies. The nine in Lake Huron, from north to south, are as follows: St. Martin Shoals, off St. Martin Bay, Upper Peninsula, about 8 miles north-northeast of St. Ignace;

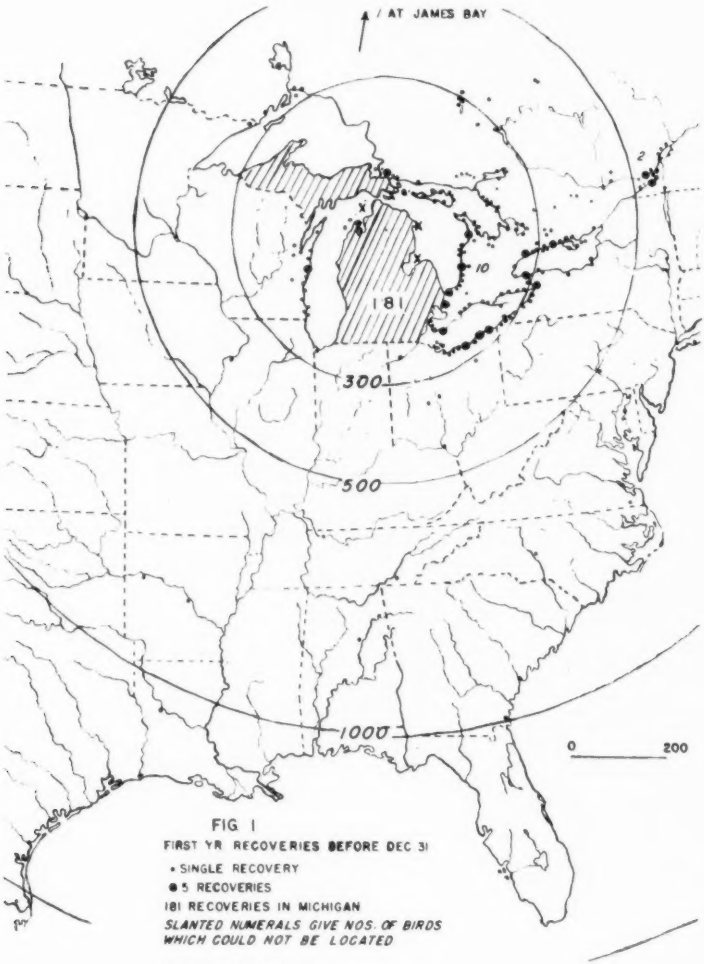
* This paper was prepared in partial fulfillment of the requirements of the degree of Master of Science at Michigan State University.

TABLE I Nos of gulls banded in each colony.

	Lake Huron									Lake Michigan							
	BLACK RIVER	SULPHUR	SCARECROW	SUGAR	GULL	THUNDER BAY	ST MARTIN SHOALS	GOOSE	LITTLE CHARITY	SHOE	HATT	PIZMIRE	BIG GULL	GREEN	BELLOW	ROUND IS. LAKE SUPERIOR	NO. OF BIRDS BANDED EACH YEAR
1931	14																14
1932	9	11															20
1933	18	8	43	69													136
1934	10		4	160						3	578						755
1935	107		121	483	298	5				7	167	347					1535
1936	46		149	353		514				12	430	49	376				1929
1937	240		157	210	331		439	30		1	223	380		174			2185
1938	46		196	391	640		443	16		1	545	435	240	193			3146
1939	301		249	888	711		409			6		431	398	253	401		4027
1940	264		248	396	575		281		8	3	151	232	152	131	202	155	2798
1941	260		185	229	582		482		145	10	129	408		164	394		2988
1942	9								2								11
1946	331	4	161	231	262									169			1158
1947	465													373			838
1948	518		204											39	459		1220
1949	400														401		801
1950	1087		85								101	439	381		1113		3206
1951	719														1228		1947
1952	460						182				116	52			1096		1906
1953	860																860
1954	478		566												1522		2566
1955			56												1054		1110
1956	261		306						27						617		1211
1957	402								640								1042
	2001	23	928	3390	3399	519	2236	46	822	43	2440	2773	1547	1496	8487	155	37409
										GRASS IS. L. MICH. 1950, 5							5
										TOTAL NO. BANDED							37414

NONE BANDED 1943–1945 INCLUSIVE

Goose Island, about 10 miles to the east off Marquette Island; Thunder Bay Island, Sugar Island, Gull Island, Sulphur Island, and Scarecrow, in Thunder Bay or just off North Point by Alpena; Black River Island, a mile and a half off Black River 17 miles south of Alpena; and Little Charity Island in Saginaw Bay, 32 miles northeast of Bay City. On these nine Lake Huron colonies 20,168 gulls, 54.71% of the total, were banded. On the seven Lake Michigan Islands 16,791 gulls, 44.89%



of the total, were banded. Four of these islands, Gull, Pizmire, Hatt, and Shoe, are in the Beaver Island group, Gull and Pizmire lying to the west of Beaver Island beyond High Island, and Hatt and Shoe lying north and a bit east above Garden and Hog Islands. Bellow Island is in the mouth of Grand Traverse Bay north of Traverse City, and Green Island lies in the western Straits of Mackinac, about 6 miles northwest of Mackinaw City. There remains Grass Island, a low island in the Beaver group on which only five gulls were banded, and none of these five has been recovered. In Lake Superior the Ludwigs banded

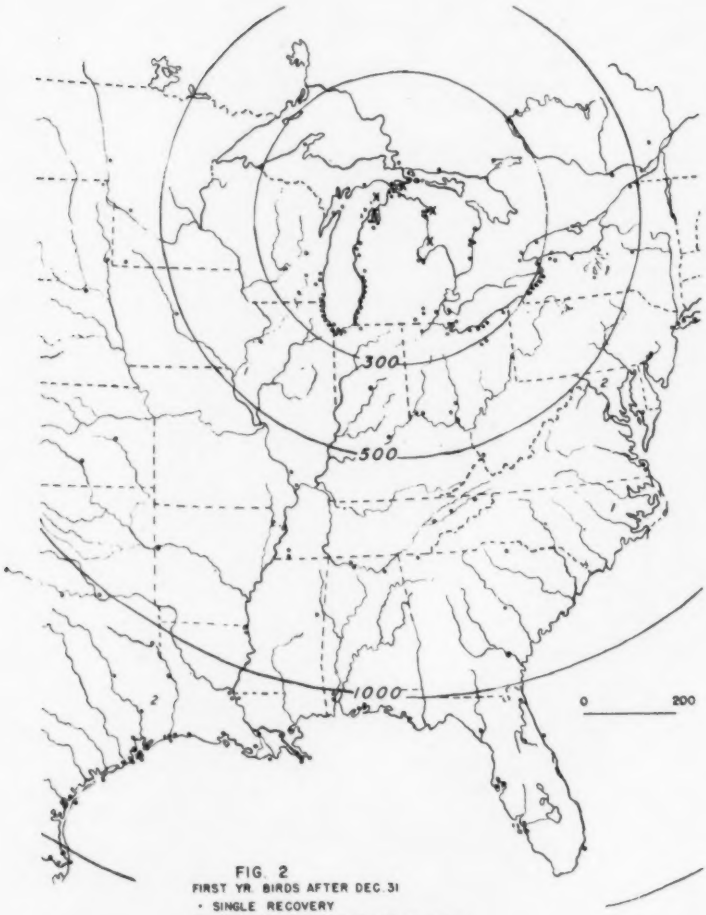


FIG. 2
FIRST YR. BIRDS AFTER DEC. 31
· SINGLE RECOVERY
SLANTED NUMERALS GIVE NOS OF BIRDS WHICH COULD NOT BE LOCATED
X SITES OF COLONIES

only on Round Island, just east of Brimley at the head of St. Mary's River and only 155 birds in one year, 0.41% of the total.

Table 1 shows the number of gulls banded each year in each colony, and the total number banded in each colony in the 24 years. No banding was done from 1943 to 1945 inclusive. Fig. 1 shows the locations of colonies or groups of colonies except for Round Island from which there have been only nine recoveries.

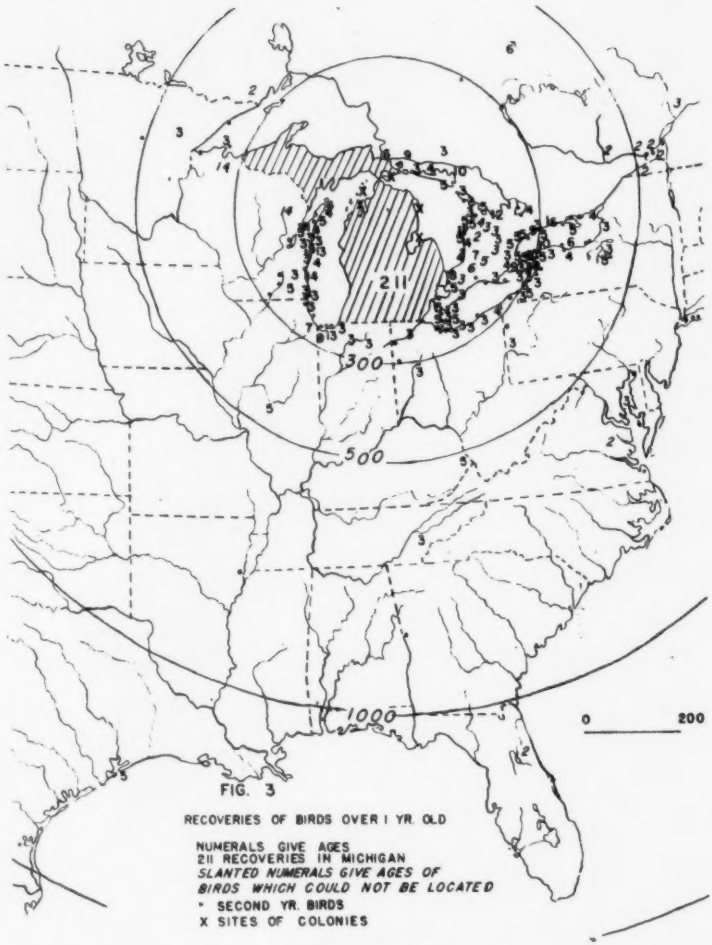


FIG. 3

RECOVERIES OF BIRDS OVER 1 YR. OLD

NUMERALS GIVE AGES
211 RECOVERIES IN MICHIGAN
SLANTED NUMERALS GIVE AGES OF BIRDS WHICH COULD NOT BE LOCATED
* SECOND YR. BIRDS
X SITES OF COLONIES

MOVEMENTS

Five maps (Figs. 1 to 5) show the distribution of the 1,143 recoveries. In some ways it might have been preferable to present this material as a unit and to use only one map for each of the three age groups recognized. The large number of recoveries, however, could not have been properly represented on the small scale this would have required. Accordingly, these age groups are presented separately only on those three maps showing the United States (except Maine), Ontario and part of Quebec. All recoveries from eastern Quebec, the Atlantic Provinces and Maine are shown together on one map, and all recoveries from south of the United States on another. The areas in

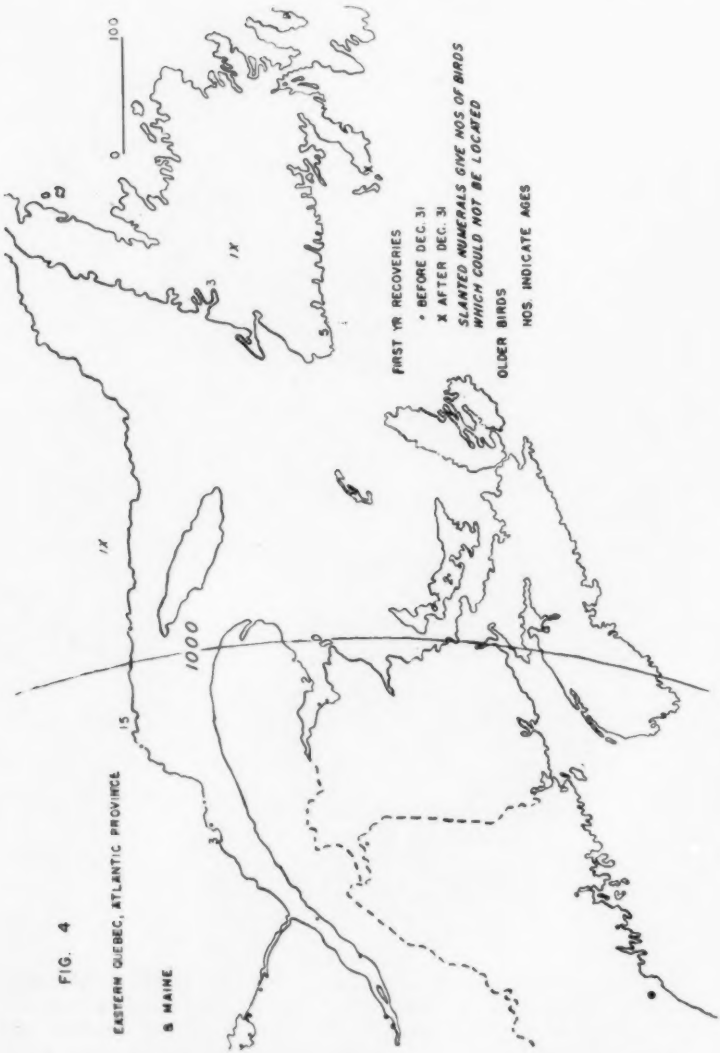


FIG. 4

which groups of colonies or single colonies are located are marked on the maps of the United States, but no attempt has been made to indicate each colony in a group as I felt the desirability of using a large symbol for place of origin outweighed any advantage the alternative might have. A centre of origin to which to relate the linear distance flown has been chosen and is indicated.

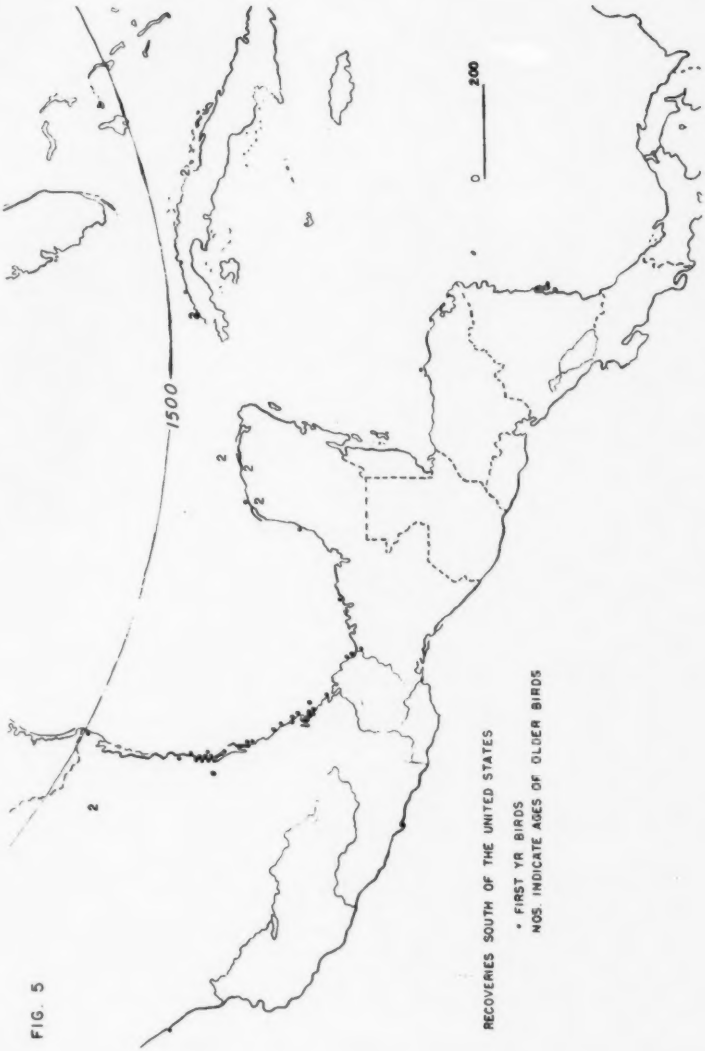


FIG. 5

The advisability of dividing the data into age groups was recognized after completing a preliminary plotting, and the groups were chosen in accordance with their correlation with obvious distributional tendencies (see Table 2). These groups, then, are as follows:

	FIRST YR.		BEFORE DEC. 31	JAN. 1 TO JUNE 30	OVER 1 YR.	
	NO.	%			NO.	%
MICH.	214	50·3	181	33	211	49·7
ONT.	177	67·8	162	15	84	32·2
WISC.	29	46·8	19	10	33	53·2
ILL.	12	70·6	1	11	5	29·4
IND.	8	50	1	7	8	50
OHIO	44	74·6	29	15	15	25·4
PENN.	6		5	1	2	
N.Y.	33	56·9	16	17	25	43·1
ME.	4		4			
P.Q.	44	78·6	42	2	12	21·4
N.B.	3		3			
P.E.I.	2		2			
NFLD.	2			2	2	
N.J.	3		1	2		
MD.	4		2	2	1	
VA.	3		1	2	2	
W.VA.	1			1		
N.C.	2		1	1		
S.C.	1			1		
GA.	4		1	3	1	
FLA.	12	92·3		12	1	7·7

	FIRST YR.		BEFORE DEC. 31	JAN. 1 TO JUNE 30	OVER 1 YR.	
	NO.	%			NO.	%
ALA.	6		1	5		
KEN.					1	
TENN.	7		2	5	1	
MISS.	1			1	1	
MINN.	4		1	3	5	
SO. DAK.	2			2		
TEX.	33	91·7	3	30	3	8·3
IOWA	1			1		
NEBR.	1			1		
KANS.	2			2		
MO.	1			1		
ARK.	4		2	2	1	
LA.	15	100	1	14		
OKLA.	1			1		
CUBA	2			2	2	
MEXICO	32	88·9	1	31	4	11·1
HONDURAS	1			1		
NICARAGUA	1			1		
BAHAMAS	2			2		
TOTALS	724	63·3	482	242	419	36·7

TABLE 2 Recoveries by age groups

(1) birds recovered between the time of banding and December 31st of their first year, except, as noted above, those recovered on or within a few miles of the colonies shortly after being banded,

(2) birds recovered in the six-month period between December 31st of their first year and the following June 30th,

(3) all birds over one year old. These have been indicated on the map by figures showing the year of life in which each was recovered. In some cases the group of birds in their second year will be mentioned separately.

Of the 1,143 recoveries, 724 or 63.34% were of first-year birds. To be more specific, 42.16% of the total were of birds recovered before December 31st of their first year, and 21.2% between December 31st and June 30th. Thus some 419 birds, or 36.6%, were recovered subsequent to their first year, and of these 32.2% (135 or 11.8% of the 1,143) were second-year birds. The high mortality of first-year birds, particularly up to December 31st, will be discussed below.

Michigan Recoveries

The home state of Michigan yielded 425, or 37.18% of all recoveries. About half, 50.35%, were first-year birds. If we analyze the Michigan recoveries by month we see that many Herring Gulls leave in December

Month	J	F	M	A	M	J	J	A	S	O	N	D
Percent of the Michigan recoveries	2.9	2.7	2.2	2.8	7.6	9.3	9.8	20.2	13.3	11.9	11.9	5.2

and some at least return at the end of April, although many over-winter in the state. Certainly part of the reason for the larger number of summer returns is that more people frequent beaches then, and from July on we must further consider the appearance of young of the year, among which mortality is high. This latter point may be demonstrated by dividing the percentage of the recoveries in each month into two categories, percentage of first-year birds and percentage of older birds:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Percent of recoveries (1st year)	1.9	1.0	1.0	1.4	2.4	0.0	1.7	10.7	10.2	8.6	7.6	3.1
Percent of recoveries (older)	1.0	1.7	1.2	1.4	5.2	9.3	8.1	9.5	3.1	3.3	4.3	2.1

This does show a heavy mortality of young in August, September, October and November, and indicates either that this rate of mortality drops quickly by December or that the young birds scatter out of Michigan. The maps show the latter to be at least partly the case, and probably both causes are operative. Considerably more adults than first-year birds appear to winter in home waters. The increased number of recoveries of adults in June, July and August may largely reflect the distribution of people who find the gulls.

Twenty birds banded in the colonies were recovered there in later years as shown below. Note that 13 of the returns were of fully mature

Colony Where Banded	Recovered in Same Colony	Recovered in Another Colony	(Ages and colony of recovery in brackets)
Hatt	1 (1)		
Gull (L. Huron)	1 (7)	2	(2, Bl. River; 10, Sulphur)
Pizmire	2 (6, 9)	2	(4, 4, both at Gull, L. Mich.)
Green	1 (11)		
Scarecrow		2	(1, 1, both at Bl. River)
Black Rver	5 (2, 1, 5, 4, 3)	1	(4, Little Charity)
St. Martin Shoals		2	(12, Sugar; 15, Bl. River)
Bellow	1 (19)		
	11	9	

birds, four years or older. If the birds recovered were breeding, then there is at least some exchange between colonies, although perhaps not much between lakes. This is further shown by two birds recovered by the Ludwigs but not banded by them: one banded by A. D. Trempe in 1932 at Hatt Island and found dead in 1940 on Black River Island, and one banded by W. I. Lyon in 1932 on Big Gull Island, Lake Michigan, and recovered in 1938 on Sugar Island, Lake Huron. The

list also shows some return to the colony of birth, and this is further substantiated by a bird banded by W. I. Lyon in 1935 on Green Island and recovered there in 1936 by the Ludwigs.

Linear Distances of Recoveries from Colonies

To examine the distances at which recoveries were obtained I have drawn circles of 300, 500, 1000, and 1500 miles radii from the center point. Below are listed the numbers and percentages of the total of recoveries within each circle.

	First-Year Birds Until Jan. 1st		First-Year Birds Jan. 1st to June 30th		Total, First-Year Birds	
	No.	Percent	No.	Percent	No.	Percent
Within 300 miles	359	31.4	77	6.7	436	38.1
300-500	53	4.6	26	2.3	79	6.9
500-1,000	61	5.3	43	3.8	104	9.1
1,000-1,500	7	0.6	56	4.9	69	5.5
Over 1,500	2	0.2	40	3.5	48	3.7

	Second-Year and Older		Second-Year Birds		Third-Year and Older		Grand Total
	No.	Percent	No.	Percent	No.	Percent	
Within 300 miles	345	30.2	79	6.9	266	23.3	781
300-500	43	3.8	17	1.5	26	2.3	122
500-1,000	19	1.7	14	1.2	5	0.4	123
1,000-1,500	6	0.5	3	0.3	3	0.3	69
Over 1,500	6	0.5	5	0.4	1	0.1	48

Obviously first-year birds, particularly in the period between January 1st and June 30th, fly farther than older birds. This is in agreement with the calculations made by Gross (1940) for mean distances flown by different age groups of Herring Gulls from colonies both in the Great Lakes and at Kent Island, New Brunswick.

Dispersal Pattern

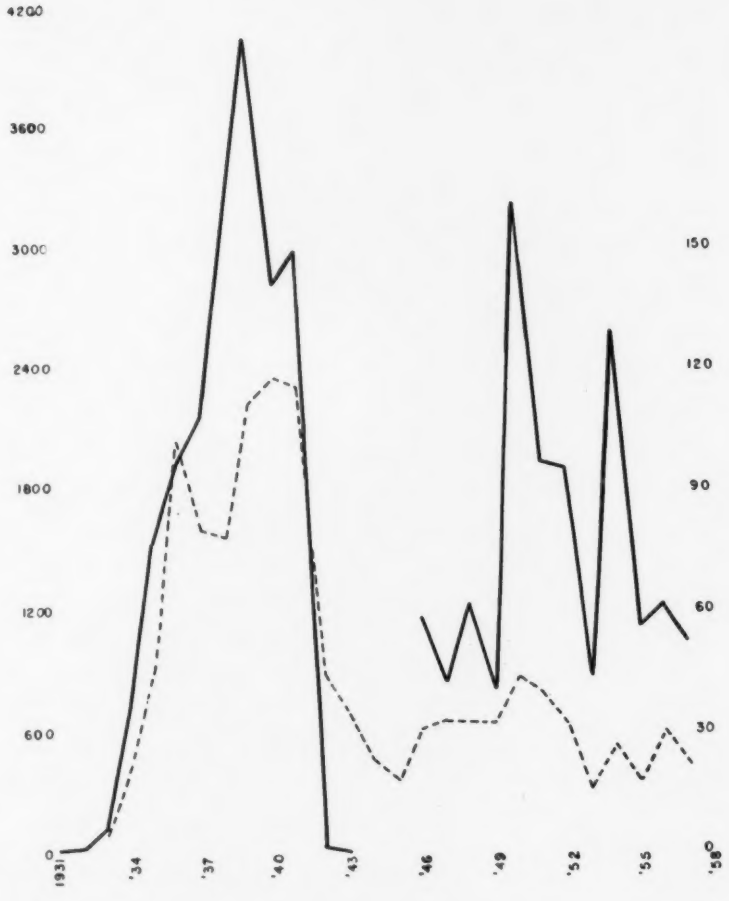
Recoveries were most frequent from the shores of the Great Lakes, in particular Michigan, Huron and Erie with a considerable number, however, from Lake Ontario, and relatively few from Lake Superior. Most Michigan recoveries were from the lake shores, and the remainder almost all from river systems. Out-of-state recoveries fall into two categories, both well represented:

(1) the Mississippi River and its tributary system accounting for virtually all of the inland records west of the eastern mountains,

(2) the seacoasts, including:

(a) the Atlantic coast and the rivers leading to it, as well as the coasts of Cuba and the Bahamas, and

(b) along the cost of the Gulf of Mexico, including Nicaragua and Honduras. Of the 38 records, exclusive of the West Indies, from south of the United States only one, from Monterrey, Mexico, was any appreciable distance inland (although one from the West coast of Mexico represents a bird that had crossed that country, perhaps at the Isthmus of Tehuantepec in the company of such other soaring coastal species as the Magnificent Frigate Bird, *Fregata magnificens*, which Dalquest [1951] observed over the Isthmus).



GRAPH 1 ——— no. banded per year, scale on left.

------ no. recovered per year, scale on right.

Exactly how the gulls reach the Atlantic coast cannot be determined from the recoveries, but probable routes can be shown. Of the 57 recoveries in this group (West Indies excluded; the St. Lawrence River below Father Point included), five on the mainland could not be located from the data available. Of the other 52, 39 were on or near the coast, or on islands, such as Newfoundland, off the coast. Sixteen in the Gulf of St. Lawrence area show this river to be a main

artery to the coast. The remaining 11 were on rivers flowing to the coast south of the St. Lawrence. Four on the upper Hudson may indicate another link between the Great Lakes-St. Lawrence system and the coast, a possibility considered below. There are six records from rivers in Georgia, the Carolinas, Virginia and Pennsylvania, and one from very near the St. John River in Maine. These could represent birds that have flown overland to these rivers, as Gross (1940) believes, or birds that have been on the coast and followed these rivers upstream. In view of the fact that inland recoveries away from major river systems are practically nonexistent, and considering that mountain barriers lay in the paths of these seven gulls, the second alternative appears more likely. The Bonaparte's Gull, *Larus philadelphia*, a bird perhaps more accustomed to forests than the Michigan Herring Gulls of the Great Lakes, has been observed by Brooks (1952) to fly over the Alleghenies but he does not mention the Herring Gull. If the Herring Gull does not usually cross the mountains, then access to the Atlantic coast is primarily by way of the St. Lawrence and, perhaps, the Hudson Rivers.

A similar explanation might well be valid for the five recoveries of birds on rivers which are not tributaries of the Mississippi but which do flow into the Gulf of Mexico. In these cases, however, the headwaters of the rivers concerned are all very near tributaries of the great river, and there are no mountainous barriers involved.

Use of Waterways and Coasts

That Herring Gull movements should be confined to waterways is not surprising, since their food (Bent, 1921, Mendall, 1939, Otterlind, 1948, Pimlott, 1952, Spärk, 1951, Witherby, *et al.*, 1941, give the most comprehensive accounts) is primarily found in or near water. Herring Gulls are omnivorous, however, and could presumably travel overland, feeding primarily on insects and vegetable matter, and even refuse at garbage dumps. That they do not appear to do this may be traceable to certain other inducements that rivers and coasts hold for them.

The Herring Gull is a soaring bird, in fact such an accomplished soaring bird that it has been met with by aircraft at heights up to 3500 feet (Ingram, 1919, and further observations by Mitchell, 1955, and Woodcock, 1942, the latter not concerned with aircraft). When travelling it prefers to make use of up-currents of air (Tinbergen, 1953), and, indeed, will often not travel when it cannot soar — Woodcock (1940, 1942) reports that Herring Gulls are not seen 100 miles or more at sea off the east coast until the autumn when cold continental air flows out over the warm sea and creates thermal conditions. A movement of any distance is undoubtedly facilitated by up-currents, for Griffin (1943), while conducting a homing experiment with 176 Massachusetts Herring Gulls, found that rapid homing was favoured by unstable air and strong updrafts to permit soaring.

Forster (1955) has examined the use by birds of ascending air currents of two origins:

(1) those due to the effects of wind blowing up a slope or rise in the ground (slope currents and wave currents), and

(2) those due to the effects of air being heated (thermal currents). He suggests that "birds will tend to follow slope and thermal up-current lanes," and that "the use of up-currents partly accounts for the tendency to drift with the wind during migration," so that suitable thermal and drift conditions could combine to be an aid to covering distance. I shall examine the problem of drift below, but should first like to speculate on the use of up-currents by travelling Herring Gulls. During the day a gull could find not only thermal currents over beaches and shores, but also slope currents created by wind on the banks or dunes and would thus have an up-current lane beside most large waterways. Further, due to the high thermal capacity of water there would be, once the air was colder than the water, a thermal effect over all unfrozen rivers and lakes, as well as over the sea as mentioned by Woodcock (1940, 1942). McMillan (1938) states that a quartering wind on a seacoast will create a surf that will give both lift (Forster's "wave currents") and direction, and this would presumably be the case on the Great Lakes as well. If, then, the Herring Gull does follow up-current lanes because it is a soaring bird, rivers and coasts would provide another inducement, besides food, to travel along them. In support of the notion that the gulls would follow such lanes I might cite a few instances of this in other species.

In the Suez region thermal activity in the atmosphere is marked. Goodwin (1949) tells of from less than 1,000 to 4,500 birds of prey a day for seven days in October all using thermal migration. MacKintosh (1949) writes of the same phenomenon in which he says tens of thousands of Accipiters pass over Suez in the autumn. The hawks are careful to avoid crossing the Gulf over which they would have to flap, probably because they have low reserves, but storks, herons, and pelicans which also migrate on the thermals do use flapping flight to cross the water. At the western end of the Mediterranean area Moreau (1953) found that soaring birds would converge at the Straits of Gibraltar to make the water crossing (which would be without the aid of thermals) as short as possible. He felt that the coastline guided them to the Straits.

In southern Sweden Rudebeck (1951) has observed a "very close correlation" between weather conditions suitable for soaring and the migration of several species of hawks, "particularly those species which are most inclined for soaring." In an earlier paper (Rudebeck, 1950) he stated that these hawks allow themselves to drift within the limits of the leading lines provided by the coasts of Sweden and Denmark. Thomson (1953) calls the tendency to be deflected by topographical features which act as "leading lines" an intrinsic factor of orientation which is probably a reaction to a barrier between a favourable and an unfavourable habitat. This, then, is an example of a group which combines migration by soaring with the following of leading lines. Broun (1939) noted that hawks passing over Hawk Mountain, Pennsylvania, in the autumn flight coast on the up-currents of air caused by wind striking the flanks of the mountain.

The Factor of Prevailing Winds

From the maps showing first-year birds it can be seen that recoveries in the autumn and early winter tend to be from the east, northeast and north, whereas winter and spring recoveries are from the south and west. Although the over-all dispersal pattern seems to include all points of the compass, few birds travel far before January that do not go east. It is probably more than coincidence that the prevailing winds at this season are from the southwest.

To be more precise, in August the prevailing wind is west over Lake Superior and southwest down the Great Lakes-St. Lawrence system. In September and October it is similar with a north to northwest tendency down the East coast which continues at least into February—although with frequent westerly components. In December, however, there is a shift to northwest across the Great Lakes, northerly components are frequent down the Mississippi, while the prevailing wind on the Gulf of Mexico coast is north or northeasterly and remains so through February. The January winds of the southern Great Lakes tend to be west or southwest, a condition which is common both winter and summer, but which may give way to northwesterlies particularly in the spring. In March the winds on the Gulf of Mexico, including the Mexican coast, become south to southeast but remain the usual northeast over Yucatan, Central America, Cuba and the Bahamas. By April there is a good degree of southerly flow up the Mississippi and up the East coast (Kendrew, 1953; Baker, 1936; Bartholomew *et al.*, 1899, and *Climatological Data*, U. S. Department of Commerce Weather Bureau).

This pattern fits, in general, the seasonal movements of Michigan Herring Gulls rather well. The possible use of the Hudson as a lane to the coast may be further considered here as recoveries are fewer than might be expected if it were used to any extent. It may be that it does not get much use for the prevailing autumn winds are upstream from the south, both at the surface (Baker, 1936) and at an altitude of 500 metres (U. S. Department of Commerce, Weather Bureau, 1941).

I have already mentioned Forster's (1955) statement that "the use of up-currents partly accounts for the tendency to drift with the wind during migration." For some reason, though, early accounts such as Cooke (1910, 1913a), and even Thomson (1936) and Allen and Peterson (1936), considered that wind is not important, other than accidentally, as a determining factor in migration. This attitude was long lodged in the literature. That wind is important to birds using thermal migration has been attested to by MacKintosh (1949) who noted that migrant Accipiters in the autumn may find themselves considerably south of Suez on the wrong side of the Gulf and have to turn north to Suez to avoid flapping over water. He attributed this southward drift to the fact that the prevailing north wind of the autumn season carries the birds south with the thermals themselves. Regarding Herring Gulls, Griffin (1943) in his homing experiments noted that rapid homing was favoured not only by strong updrafts and good visibility, but moderate to fresh "favorable winds."

That winds do cause birds to go far out of their intended way has been long known, but has been thought to be a relatively rare tragedy

when it occurred on a large scale, as in the case, for instance, of the wind of an unseasonal anticyclonic pressure system in the spring of 1948 that carried thousands of Redwings, *Turdus musicus*, to Britain and to their deaths in a snow storm (Suffern, 1949). The unsuspected enormity of unintentional wind drift has now been realized by Williamson (1952), however, who believes that "such passage migration as we encounter over the greater part of Britain is largely due to . . . displacement by easterly winds from their [the birds'] Continental coastal 'guiding lines' between Skaggerak and northern France." These migrants are so regular that they were formerly thought to be on a particular over-water flyway in order to explain their occurrence. Williamson argues that anticyclonic conditions over North or Central Europe initiate southward autumn migration on the part of large numbers of birds, and that the easterly airstream south of the anticyclone creates a certain amount of westward drift—enough to result regularly in wastage on a "colossal scale" of those birds carried beyond the British Isles. An example in North America of the effect of a shift in the prevailing wind is given by McCreary (1934). During the first half of May, 1933, in East Wyoming the prevailing wind, normally southwest, blew almost continuously from the east, southeast or northeast, and pushed birds west which normally pass further east. The birds he mentions were all small species except for Franklin's Gulls, *Larus pipixcan*.

From such evidence it would appear that wind does have a very major effect on the direction of bird migration, if only to hamper the birds in following their usual course. Further recent papers, however, show very definite correlations between wind patterns and normal migration routes and behaviour. Landsberg (1948), for instance, has pointed out that there is a close resemblance between certain generalized trajectories of air currents and the migration routes of the Arctic Tern, *Sterna paradisaea*, Wheatear, *Oenanthe oenanthe*, Pacific Golden Plover, *Pluvialis dominica fulva*, and Greater Shearwater, *Puffinus gravis* (northward). This has also been noted by Allen, 1948, for two of those species, the Arctic Tern and the Golden Plover, *P. d. dominica*, but in this case the claim is made for the flight of the latter from Nova Scotia to South America. Landsberg further suggested that prevailing conditions would account for the scatter that occurs, that is, the deviations individual birds or flocks make. MacMillan (1938) has also proposed that whenever possible migrating birds ride the wind, and that migration routes are thus correlated with prevailing wind. Clear quantitative demonstrations of this have been given by Lowery and Newman (1955) from their studies of nocturnal migration, and Devlin (1954) who also studied nocturnal migration. Dennis (1954) has observed that southerly winds generally attend the northward departure of migrants from the Gulf of Mexico coast, and that northerly winds in the spring result in an arrested wave. Dennis and Whittles (1955) have noted that autumn migrants reach Nantucket on northeasterly or northwesterly winds, and Stanford (1953) that many birds arrive from over the desert in Cyrenaica in spring with a south wind, sometimes very strong, behind them, and further migration across the Mediterranean is held up by north or northwest winds. Broley

(1947) usually found that his Bald Eagles, *Haliaeetus leucocephalus*, migrated north from Florida up the Atlantic coast after the breeding season. In April, 1945, however, the prevailing wind, which normally is from the south up the Florida coast in April and May, shifted and blew across Florida and then swung north up the Mississippi valley. That year he got four inland recoveries.

Not all observations correlating the arrival of birds with tail-winds can be used to support the notion that birds deliberately migrate with the wind, of course. Some are cases of drift out of preferred migratory paths, and it could be that the birds involved were not using the winds as tail-winds but were (as Williamson has postulated) actually heading across the winds. Such is likely the case in the hawk migrations at Cape May Point described by Allen and Peterson (1936). Here birds which normally pass southwestward somewhat inland are crowded into the narrow cape by a northwest wind. The flights observed by Ferguson and Ferguson (1922) for five fall seasons on Fishers Island, New York, show a good correlation with northwest wind for the partly-soaring Sharp-shinned Hawk, *Accipiter striatus*, but not for the stronger flying falcons which could fly into opposing winds. The Sharp-shins flew "slightly sideways" because of the wind. Smith's (1908) observation of over 10,000 Purple Martins, *Progne subis*, migrating south down a quarter-mile wide strip along the east shore of Lake Michigan would indicate by virtue of sheer numbers that the birds were migrating with the northeast wind and were being turned across it to follow the guiding line of the shore by the water barrier. Had they not begun by flying *with* the wind could such a concentration have occurred, that is could drift alone, acting on birds flying with a southerly heading, be responsible? Bennett (1952), on the basis of five years' study of migration at Chicago during which every important autumn wave was associated with an advancing cold front followed by northwest winds, concluded that birds migrate *with* the wind. A clear case of migrating with the wind is recorded by Broun (1939, 1951) for the hawks soaring on the slope-currents of Hawk Mountain, Pennsylvania. Of those counted in September and October from 1934 to 1938, 61.9% passed on a northwest to northeast wind, and many more hawks were aloft on days with northerly winds than on any other days.

Whether Michigan Herring Gulls seek westerly winds with which to fly, or are simply put adrift by them, it does not appear unlikely to me that the eastward tendency of their autumn dispersal is to a large degree correlated with the prevailing wind. The situation is complex, though, and the influence of the Great Lakes-St. Lawrence system as a guiding-line might be even more important. If it were, however, I should expect more birds to scatter west along the shores of Lake Superior than are indicated by the recoveries.

There is perhaps a further consideration. Deelder and Tinbergen (1947) cite Lorenz's observation that crows, geese and gulls migrate low against the wind but high with a tail-wind. The reason for the latter Lorenz supposes to be that a gust from behind would cause these large birds to lose relative airspeed temporarily and descend, hence they must be well above obstructions. Now Dobben (1953) adds that since birds react less to topographical features as they fly higher a following

TABLE 3	TOTALS	BLACK RIVER	SULPHUR	SCARECROW	SUGAR	GULL	THUNDER BAY	ST. MARTIN'S	GOOSE	L. CHARITY	SHOE	HATT	PIZMIRE	BIG GULL	GREEN	BELLOW	ROUND
MICH.	425	56		36	38	49		38	1	13	1	28	52	45	24	39	5
ONT.	261	32	1	24	53	56	2	22	1			18	11	16	9	14	2
WISC.	62	1			6	5		5				4	18	10	7	4	2
ILL.	17	3			1			1				5	3		2	2	
IND.	16	4						2				2	5		1	2	
OHIO	59	6		6	12	7		3				6	4	6	7	2	
PENN.	8	2		1	2							1				2	
N.Y.	58	4		7	13	12		8		1		1	4	3	2	3	
ME.	4					2				1				1			
P.Q.	56	11		1	10	16		5		1		2	2	4		4	
N.B.	3	2		1													
P.E.I.	2	2															
NFLD.	4	2				1						1					
N.J.	3					3											
MD.	5	1		1	2							1					
VA.	5												2		1	1	
W. VA.	1															1	
N.C.	2			1												1	
S.C.	1													1			
GA.	5				2	1		1					1				
FLA.	13	2		1		4		1				1	3	1			
ALA.	6	1			1			1				1	1	1			
KEN.	1													1			
TENN.	8	1			1	2		1					1	1		1	
MISS.	1			1													
MINN.	9	1				1		2				2	1	1	1		
SO. DAK.	2											2					
IOWA	1	1															
NEBR.	1													1			
KANS.	2				1											1	
MO.	1												1				
ARK.	5	1				1						2		1			
LA.	15				5	1						3	2		2	2	
OKLA.	1				1												
TEX.	36	1		3	6	4		3		1		8	3	3	1	3	
CUBA	4	1										1				2	
MEXICO	36	5		3	1	6		3				4	4	3		7	
HONDURAS	1											1					
NICARAGUA	1	1															
BAHAMAS	2					1							1				
TOTALS	1,143	141	1	86	155	173	2	96	2	17	1	94	119	99	57	91	9

TABLE 3 Recoveries by colonies of banding.

wind serves to weaken the guiding-line effect. If this is the case, then the guiding-lines could here be drawing the gulls either east or west, but the prevailing wind would tend to send them east, and would actually weaken the effect of the guiding-line on days when it reached a high velocity.

Dispersal and Colony of Birth

In order to see if there was any relationship between the colony of birth and the direction of dispersal (see Table 3) the contingency chi-square method was applied to a table listing numbers of recoveries by areas with the colonies where the birds had been banded. To have numerical values sufficiently large for the use of this method a certain amount of grouping was necessary, so that colonies geographically close together were grouped, and the places of recovery were lumped into five areas with Michigan and Ontario considered separately. Since the probability of a chi-square greater than that obtained was less than 0.5%, there is apparently some relationship. This appears to be largely that more birds banded in Lake Michigan tend to be recovered in Wisconsin, Illinois or Indiana than in Ontario, while birds from Lake Huron show the opposite tendency. This might be expected since the birds commence to wander on the lake of their birth. Birds from the St. Martin Shoals colony on the Lake Huron side of the Straits of Mackinac show no relationship which would support this idea, although birds from the Beaver group of colonies in Lake Michigan show a marked tendency not to go to Ontario. There is variation from colony to colony significant at the 5% level for the Lake Michigan colonies and at the 10% for Lake Huron, either to show the tendency characterisic of the colonies as a whole in that lake, or to show no tendency at all. It is difficult to know whether these tendencies indicate a slight genetic difference between some of the colonies (recall, however, that nine birds banded in one colony were recovered in another) or are merely an imperfect reflection of the geographical influence. A less marked tendency for more Lake Huron gulls to go to the East coast rather than the Gulf of Mexico, the Lake Michigan birds again showing the opposite tendency, is probably a reflection of their original dispersal on the later southward movement. It would follow if birds which have wandered to the lake shores of Ontario continue to drift down the Great Lakes-St. Lawrence system with the winds, while birds which have reached southern Lake Michigan would have to let the wind carry them away from the shores and across the southern part of the state of Michigan.

Southward Movement

Figure 2, graphs 2 and 3, and Table 4, reveal that most recoveries from southern states and Mexico occur in the period from January 1st to June 30th, the graphs showing that birds actually begin to appear at least in the southern states in December. The southward movement (characteristic only of first-year birds) is probably due to a number of factors such as the prevailing north winds of December and January, the freezing of northern rivers and the new difficulties shore ice brings to finding food, and perhaps a simple movement in the direction of greatest warmth as proposed for many European species by Drost (1929). Lincoln (1950) has suggested that this southward movement is the product of a "directive migratory impulse," but I should like to point out that (a) the movement begins very late in the year, and, more important, (b) only the first-year birds take part to any extent. As sexual maturity is approached and attained, wandering of more than

GRAPH 2 Sum of recoveries from Md., Va., W.Va., N.C., S.C., Ga., Fla., Ala., Ken., Tenn., Miss., Kans., Mo., Ark., Okla., La., Tex., by month.

GRAPH 3 Mexican recoveries by month.

two to three hundred miles is largely given up (see Figure 3). It is noteworthy that the two southernmost recoveries, a bird from Honduras on February 2, 1935, and one from Nicaragua on February 8, 1938, are both first-year birds. Rather than a migratory impulse it would appear that sexually immature gulls may simply experience less of an attraction to the breeding grounds than do adults, and are thus more free to wander as weather and comfort direct.

TABLE 4 Total recoveries by month for those in which date of recovery was reported.

	J	F	M	A	M	J	J	A	S	O	N	D
MICH.	12	11	9	12	33	39	41	85	56	50	50	22
ONT.	11	6	5	7	8	7	10	21	59	58	39	26
WISC.	4	2	3	7	4	2	4	6	7	6	10	7
ILL.	3	2	2		3	2	3	1				1
IND.	3	4	1	1	3	1						2
OHIO	5	3	6	4	2	2		10	9	7	4	7
PENN.			2					1	2	1	1	1
N.Y.	7	5	3	6	5		2	6	7	7	3	7
ME.									2	1	1	
P.Q.					2	2	1	6	21	12	8	3
N.B.									1	1		1
P.E.I.											2	
NFLD.			1	1	1							
N.J.		1				1			1			
MD.		1	1	1						2		
VA.				3					1		1	
W.VA.				1								
N.C.			1									1
S.C.	1											
GA.	2	1					1					1
FLA.	6	4	1	2								

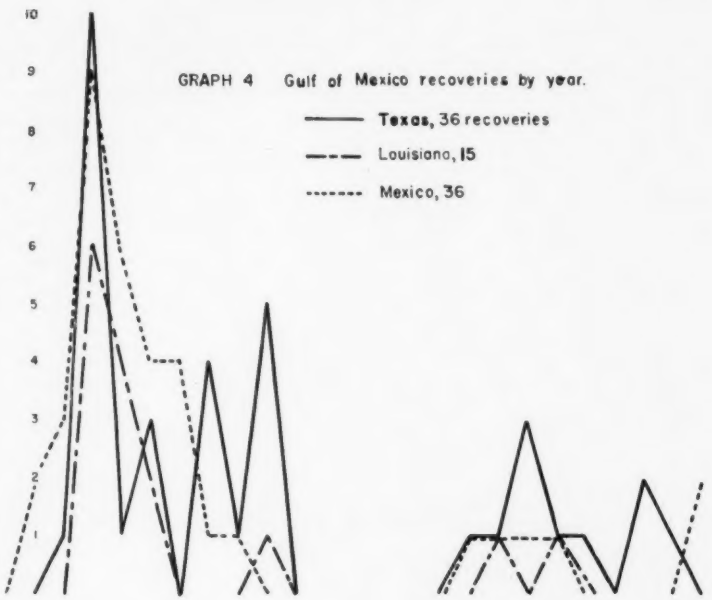
	J	F	M	A	M	J	J	A	S	O	N	D
ALA.	2		2		1							1
KEN.		1										
TENN.	2	1	1		2							2
MISS.	1											
MINN.				1	2	1			1	1	2	1
SO. DAK.				1	1							
TEX.	8	6	5	5	5	2	1				1	3
IOWA						1						
NEBR.					1							
KANS.				2								
MO.	1											
ARK.		1				1						2
LA.	5	5	1	2		1						1
OKLA.				1								
CUBA		3								1		
MEXICO	9	7	6	7	2	1		2	1			1
HONDURAS							1					
NICARAGUA						1						
BAHAMAS						1	1					
TOTALS	82	64	50	64	75	66	64	138	68	147	122	90

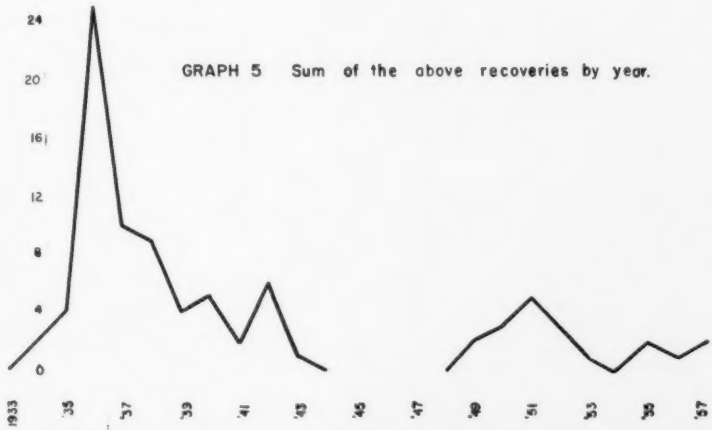
Western Recoveries

The most westerly inland recoveries (except one from Monterrey, Mexico) are 11 first-year birds recovered west of 95° west longitude in Minnesota, South Dakota, Iowa, Nebraska and northern Texas. All are from tributaries of the Mississippi and ten are recoveries in April, May or June (one in January in Texas) and probably represent birds attempting to return to the Great Lakes but led astray by mistaken guiding-lines, their tendency to return to the colonies not yet fully developed.

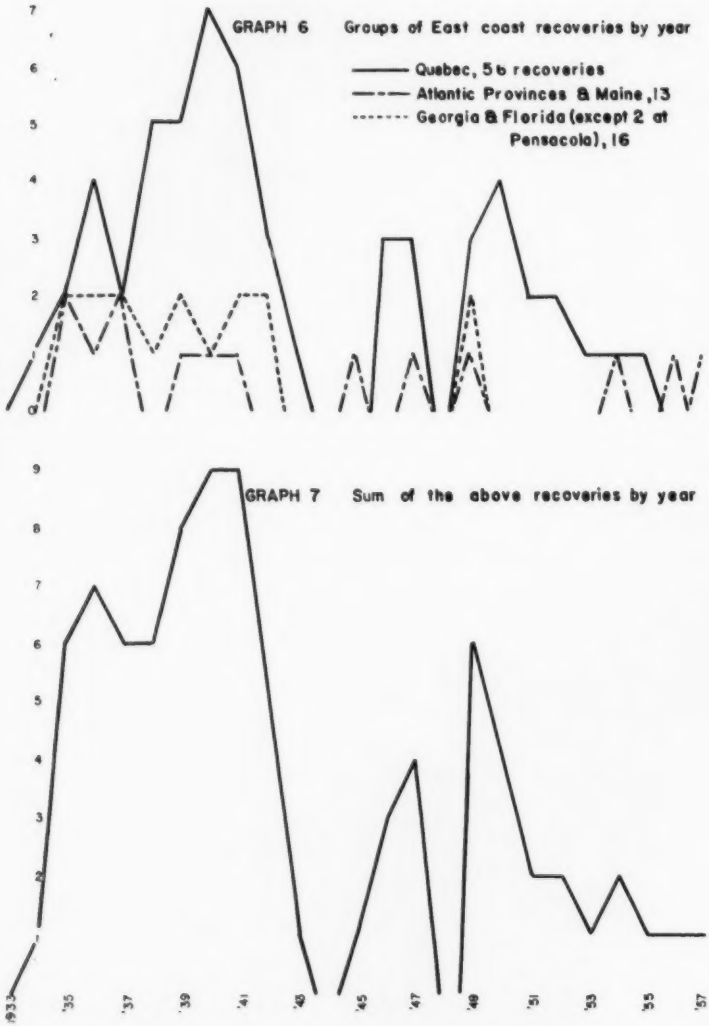
Coastal Recoveries

Discussion of coastal recoveries will start with the Gulf states and Mexico. On graph 4 are plotted recoveries from the coastal regions of Texas and Louisiana, and these are summed in graph 5. First-year birds account for 90.80% of the 87 recoveries. Of these 87, 74 or 85.06% were first-year birds taken after January 1st—there are only five from December: one in Mexico, one in Louisiana, and three in Texas. The remaining eight birds were older than one year: two from Texas were in their second year and one in its fifth, four from Mexico were in their second and one in its *sixteenth*.





Correspondence between these two graphs and graph 1 showing the totals banded per year is only superficial. On graph 5 a recovery peak in the year 1936 is prominent. This consisted of 25 recoveries of birds banded in 1935, a year when 1,535 were banded. A banding peak of 4,027 individuals was attained in 1939, but 1940 saw only four recoveries from the Gulf region, and only one of these (Mexico, January) was banded in 1939.



Since some 9,277 birds had been banded by 1938 and not recovered by 1940, as compared with 853 banded by 1934 and not recovered by 1936, there was ample opportunity for three more recoveries of older birds in 1940. If, then, we do not consider these three older gulls we find a ratio of about 1/65, that is 1/25 as many recoveries of first-year birds from 2 2/3 more banded (a significant difference). Thus, placed in perspective, it is obvious that these recoveries indicate that a

much larger proportion of first-year birds (not necessarily as great as 65:1, of course) reached these southerly regions in 1936 than in 1940. This is consistent with the recoveries of Caspian Terns, *Hydroprogne caspia*, banded in the Great Lakes in 1935 (Ludwig, 1942). In contrast to recoveries from other years, great distances were covered by the terns in short times as shown by four recoveries: one in Alabama (September 14, 1935), one in Cuba (November 5, 1935), one in Colombia (December 15, 1935), and a final one in Colombia (April 1, 1936). It is worthy of note that of the total of 36 Mexican recoveries of Herring Gulls in this study ten are from 1936. I have been unable to discover any environmental causes for this phenomenon, the exceptional cold of late January and early February in the southern Great Lakes region that winter being unlikely as an influence on avian movements which preceded it. Note that only very minor recovery peaks follow the postwar banding peaks and that total recoveries for the region are fewer. For some reason, however, total recoveries from all birds are lower after the three-year gap in banding.

Turning to the East coast recoveries, I have plotted those from Quebec, the Atlantic Provinces and Maine, and Georgia and Florida on graph 6, and summed on graph 7. Close in number to the previous group, there are 85 recoveries so comparison can be direct. Seventy-one or 82.4% are of first-year birds: 15 out of the 16 from Florida and Georgia, 44 out of the 56 from Quebec, and 11 of the 13 from the Atlantic provinces and Maine. In this case a major recovery peak in 1940-1941 does follow the major banding peak of 1939, indicating that different unknown factors affected the birds which went to the Gulf of Mexico. However, the second highest banding peak (3,206 in 1950) is not followed by a recovery peak, and there is a low percentage of recoveries *from all areas* (see graph 1) thereafter.

Briefly we may say that there are numerous recoveries from both the East coast and the Gulf of Mexico, and that they are primarily, being far from the colonies, birds in their first winter (see Table 2).

Recoveries North of Breeding Colonies

From the maps it is obvious that dispersal carries a number of Michigan Herring Gulls to the north of the breeding colonies. Along the lower St. Lawrence River and in Newfoundland this can probably be explained by a combination of the prevailing winds and leading-line effect, but many of the northern Ontario records, especially the one from James Bay, and a few of the Quebec records do not fit such an hypothesis. Probably, too, there are many more Michigan birds that stray into these areas than the maps would suggest, for the human population is thin and largely localized, leaving vast lake and river areas virtually uninhabited. Dispersal including northward directions is known for other Herring Gull colonies both in North America and Europe, and for various other *Larus* gulls, as will be mentioned later in this paper. Herons are notable for a northward post-breeding dispersal (Cooke, 1913b, Coffey, 1954, and many other papers) which may be somewhat different, however, in that in herons the trend seems quite pronounced. Lowe (1954), however, noted no directional tendency for the dispersal of British herons *Ardea cinerea*. The dispersal of at least

part of the northern population of Barn Owl, *Tyto alba*, in North America is also in all directions (Wallace, 1948, and Stewart, 1952). Lincoln (1950) calls the northward movement both of the herons and of the Herring Gull "vagrant migration," "governed only by the availability of food" which seems to me to be supposing a great deal. Another North American bird which goes north after breeding (apparently both adults and young) is the Bald Eagle of Florida (Broley, 1947) which, as I mentioned above, seems to rely for the direction of this movement upon the prevailing winds.

Regarding the northward component of the dispersal of Michigan Herring Gulls, then, I can only say that we do not know sufficient about the numbers of individuals involved to characterize it properly. It may be simply a function of the influence of good habitat on erratic dispersal, or there may be a variably inherent tendency to go north.

COMPARISON WITH OTHER AMERICAN HERRING GULL STUDIES

The movements of Michigan Herring Gulls as revealed by this study can now be stated briefly. In late summer and early autumn there begins a dispersal with great individual variation in the time of leaving the colonies and in the distances traversed. Second-year and older birds with a few exceptions tend to remain within 300 miles of the colonies, although some move up to about a hundred miles farther along Lake Ontario. First-year birds, however, show much greater variation. Although some 60.2% are recovered within 300 miles the remainder wander widely. During the autumn this dispersal shows a decided eastward tendency (perhaps a function of the prevailing winds) and possibly a slight degree of northward tendency. With the advent of winter, however, many first-year birds, including many of those still in the Great Lakes area, move southward along the East coast or the Mississippi and its tributaries. Some stop in Florida and a few get to Cuba or the Bahamas, but a concentration occurs on the Gulf coast of Louisiana and Texas, from which a number straggle into Mexico or, occasionally, even farther. These birds gradually drift northward in the early spring, a few wandering off to the west along tributaries of the Mississippi, and many probably reach the Great Lakes or even the breeding colonies, although they are, of course, immature and do not breed. Very few spend the summer as far south as the Gulf of Mexico.

The most valuable study for comparison is work done by Gross (1940) on 1,409 recoveries of Herring Gulls banded in the Great Lakes by H. C. Wilson and William A. Lyon. Most of the gulls were banded by Wilson on the Sister Islands, Wisconsin; Lyon banded in 50 comparatively small colonies in Lakes Michigan, Superior and Huron. The different colonies showed much similarity of dispersal pattern. As noted above, the younger, non-breeding birds as a whole flew farther from the colony than did the older birds. Dispersal was erratic but Gross noted a "distinct tendency for them to concentrate on the shores of the Great Lakes and the river courses such as the St. Lawrence, Mississippi, Ohio and their tributaries." Those which go down the Mississippi to the Gulf of Mexico fan out along the coast forming a concentration—as do the Ludwigs' birds—along the Texas coast. A

"distinct movement up [down] the St. Lawrence to Labrador and Newfoundland" is explained by Gross as a "tendency to cling to the shore lines of the lakes and to follow the river course." As I have indicated above, I feel that this is only part of the explanation and that prevailing winds play a major role. He also noticed a certain northward tendency which he felt to be merely part of a "preliminary explosive dispersal" followed later by a southward movement. He felt this to be the same situation as in other species such as the Black-crowned Night Heron, *Nycticorax nycticorax*, a subject upon which I have commented above. The map on which these 1,409 recoveries are plotted reveals a close correspondence with the dispersal pattern of the Ludwigs' birds, although the Sister Islands are somewhat more westerly than any upon which the Ludwigs banded. Gross showed that fourth-year birds do breed, and that younger birds usually do not.

Lincoln (1928), on the basis of fifty some recoveries from the Beaver Islands, was able to discern the autumn dispersal with its northward tendency, the later, often extensive southward movement, and the erratic first spring return which leaves some of the young birds in the south. From such a small sample, however, he could not give a more precise picture. These recoveries again fit the pattern presented here, but I find Lincoln's map (Figure 3 in his paper) showing recoveries between January 1st and the following midsummer to be rather misleading as presented. This is due to the use of arrows running from the colony to the point of each recovery. Arrows tend to give the impression of direct flight and I strongly suspect that many of the birds involved were returning north. The western recoveries in particular probably represent, as I have already suggested for similar recoveries of the Ludwigs' birds, cases in which the returning gull took the wrong tributary while coming up the Mississippi.

Eaton (1933) divided the Herring Gulls of the Eastern United States and adjacent Canada into three populations on the basis of what he considered to be their migratory patterns. In most cases he was working with very few recoveries and his conclusions, as he recognized, are highly speculative. These proposed populations are: (1) the Atlantic which migrates down the coast, (2) the Laurentian (St. Lawrence River) which he felt didn't migrate, but which, according to color-banding work (Poor, 1943) apparently does pass through the Gulf of St. Lawrence then south down the East coast, and (3) the Lacustrine. The latter he described as showing wide dispersal with the first-year birds tending to winter wherever there is open water on the southern Great Lakes drainage system, a lesser fraction following the Mississippi to the Gulf of Mexico, and a few wintering on the Atlantic seaboard.

His Lacustrine population is based on recoveries from birds banded in the following colonies: Red Bay (Bruce Peninsula), Ontario (9), Green Bay, Wisconsin (33), and the Beaver Islands, Michigan (89). He suggests several interpretations of the "wide dispersal" of this group. The first is that the colonies possess "no fixed habit of migration" but individuals merely "wander indiscriminately in search of a food supply and open water." With this wandering I should agree, whatever the reason why the gulls wander, as I feel that the pattern which is more-or-less recurrent annually is largely forced on the gulls' move-

ments by such environmental factors as the direction of the prevailing winds and the location of thermal lanes. Individual recoveries from the West Indies, Central America, and the western tributaries of the Mississippi are frequent enough to suggest that if there is a "fixed habit" it is not well-fixed. The tendency to disperse, however, is perhaps inherent.

Eaton's second interpretation is that the colonies may be a "mixture of two or more strains possessing different migratory traits." He derived this notion from his analysis of the "Atlantic population" in which, on the basis of very few recoveries, he believed he could detect fairly distinct wintering grounds for birds of different colonies. The work of Gross (1940) at Kent Island suggests that this is true for the Atlantic colonies at least to the extent that birds from northern colonies winter in the vicinity of more southern colonies while the occupants of the latter are farther south. I fail to see much indication, however, of two or more inherent tendencies toward "different migratory traits" in the dispersal pattern of the Michigan Herring Gulls. That some birds from certain Lake Huron colonies tend to go to the Atlantic while some from the more southerly Lake Michigan colonies tend to go to the Gulf of Mexico is likely traceable to their original dispersal on the shores of the lakes of their birth, although this itself *may* be genetically governed.

His third suggestion, namely that the Lacustrine population might be divisible on the basis of migratory tendencies into an "eastern" and a "western element" is probably unnecessary if the tendency for more birds from certain Lake Huron colonies to go to the East coast than to the Gulf of Mexico, or the opposite in the case of certain Lake Michigan colonies, is dependent upon their original dispersal on their home lakes. Environmental factors provide a much more likely explanation of the eastward, northeastward, and southward movements, and the straying of birds into the west on tributaries of the Mississippi is a function of their tendency to follow water courses. Eaton's maps of this dispersal introduce no tendencies new to the maps presented herewith.

Gross (1940) analyzed 773 recoveries (3.29%) from 23,434 Herring Gulls banded on Kent Island, New Brunswick. He found a dispersal at the end of the breeding season, but of a less erratic nature than that of the Great Lakes birds. The Kent Island Gulls tend to cling to the Atlantic coastline. Fewer go northward than southward, and the northward migration is followed later by a general southerly flight. A large number return to the natal colony to breed, but he found none banded as young in other colonies, nor any Kent Island birds breeding elsewhere. There was always a number of non-breeders of all ages at the colony in summer. Although few Kent Island birds winter on their breeding grounds, color-banding studies (Poor, 1944) indicate that many go no farther than the New York region and reproductively-active individuals leave there in January to be back at the colony by the last week in February.

MOVEMENTS OF THE EUROPEAN HERRING GULLS

Banding studies of North European colonies, such as those of Mortensen (1950) and Paludan (1953) in Denmark, indicate erratic

dispersal but quite restricted movement. In the case of Paludan's two colonies the average distances of dispersal were only 90 and 217 km., and the farthest of the 426 recoveries was only about 800 km. Tinbergen (1953) states that neither the Dutch nor the German North Sea population is really migratory—*i.e.*, there is "no shift in population area from north (east) to south (west) in winter"—but that there is mass movement along the coast. This movement is to find a safe habitat. High tides in combination with strong westerly winds completely cover the beach and the gulls' food, and the gulls shift to broad beaches where they can rest and wait for the storm to pass. Southwesterly winds are most frequent, and the gulls sail to the southwest using the rising air above the seaward slope of the coastal dunes, "and sail for hours and hours, practically without a single wing-beat." Tinbergen believes that the reason the whole population does not move southwest is that there is considerable back migration in calm weather out over the open sea—perhaps they use the soaring methods described by Woodcock (1940, 1942). When the wind is at right angles to the coast, two streams of gulls travel along the dunes in opposite directions.

Herring Gulls of the British Isles show at most only a "very moderate dispersal" (Matthews, 1952). Witherby *et al.* (1941) remark that they are "more or less sedentary, a few seem to be completely so, but [the] majority move away, though movement is almost entirely one of dispersal in any direction and [the] majority do not travel more than 200-300 miles." A distinct tendency for more extensive movements, especially of birds from the more northerly colonies, toward the south or southwest has carried a few birds to North France and the Biscay coast (Witherby *et al.*, 1941), but according to Matthews (1952), doesn't alter the general picture of moderate dispersal. Fisher (1954) credits the British subspecies, *L. a. argentatus*, which also breeds in Iceland, the Faeroes, N.W. France and the Continental North Sea coast to S. Norway, with reaching the Mediterranean. None of the few recoveries of Irish birds show movement "other than short distance dispersal" (Witherby *et al.*, 1941).

Matthews (1952) reports a "strong southerly bias" for the British birds, and notes that recoveries are largely restricted to the coast on which the colony is situated. Although the most sedentary birds may scarcely leave the colony—Lockley (1942) states that on Skokholm Herring Gulls may be feeding young as late as October, and are "back at the nesting terraces on the first fine day in November"—dispersal from the colonies commonly takes place between the end of July and mid-August with return from the end of February or early March to mid-May. During the autumn and winter their movements in British waters are greatly influenced by migrations of the herring (Witherby *et al.*, 1941). Immature birds often pass the summer south of the home colonies. Some continental birds from Norway, Holland, Denmark, Frisian Islands, South Sweden and North Germany come to the British East coast in the autumn (Witherby *et al.*, 1941), but the incidence of this is not known as the immatures of the subspecies cannot be distinguished in the field (Leach, 1944) and ringing recoveries have not as yet been numerous.

It would appear, then, that the Herring Gulls of northern Europe

and North America have essentially similar habits of wandering, although the former may make fewer flights and show less southward tendency. Even though the spatial patterns vary from one region to another all appear to include a dispersal from the breeding colonies, particularly by the young birds, the directions and distances of which are largely controlled by environmental factors. Return to the colonies is for many individuals dependent mainly upon degree of maturity, and for those that return in their first year may be simply a function of a gregarious tendency.

COMPARISON WITH RELATED *LARUS* SPECIES

In a number of related species many of the same dispersal tendencies are evident. In the closely related Ring-billed Gull, *Larus delawarensis*, for instance, banding recoveries from Great Lakes colonies (Ludwig, 1943) indicate that many of the birds go south to Florida and the Gulf of Mexico, largely by way of the Mississippi or Great Lakes-St. Lawrence systems. Some winter in the Great Lakes but most immature birds at least (recoveries of adults were few) remain south of the colonies for one or two years. Florida appears to be the site of the chief concentration.

Color-banding studies of gulls on the Pacific coast of the United States (Woodbury and Knight, 1951) show no real migration pattern, but a wandering back and forth along the coast. Recoveries from the Western Gull, *Larus o. occidentalis*, for example, show a dispersal north and south from the Oregon colonies (Ferris, 1940) in which individuals may become resident where they spend their first winter, but probably return as adults to the general region of their birth. Woodbury and Knight recognize that there is "great variation in the distance travelled by young gulls, not only among members of the same colony but also among colonies, populations or species." California Gulls, *Larus californicus*, from Klamath Falls, Oregon, and Mono Lake, California, for instance, do not travel as far as those from Utah. The Utah birds, banded at Great Salt Lake (Woodbury, Behle, and Sugden, 1946), present an interesting case of longitudinal migration. The first-year birds fan out, mostly towards the West coast, and most of them reach the Pacific, descending to it along various waterways. In their winter absence they are replaced in Utah by Ring-billed Gulls presumably (Woodbury and Knight, 1951) from Canadian breeding grounds, although why one leaves and the other comes to Utah has not been answered. Since most of the California Gulls from Utah go to the Pacific coast, they may have a genetically fixed directional tendency of the sort shown to be much more clearly present in some European birds such as Storks, *Ciconia ciconia* (work reviewed by Mayr, 1952). They would not be aided by the prevailing winds, and the authors noted no other environmental factors which could serve to direct them. However, their original dispersal is erratic both in time of inception and in direction and some remain in the interior—a lack of consistency is thus apparently common to at least several *Larus* species.

The British *Larus* gulls, as described by Witherby *et al.* (1941), also show a pattern of erratic dispersal of immature birds and a certain amount of drifting with little actual migration. Some such as the Common Gull, *Larus canus*, are partially sedentary or do not go

"any great distance" (Danish population treated by Munk, 1951), while the Lesser Black-backed Gull, *Larus f. fuscus*, shows a definite migration (Thomson, 1924) in which most birds participate, and its immatures disperse to greater distances. Matthews (1952) experimentally compared the homing ability of Herring Gulls and Lesser Black-backed Gulls. He found both to be inefficient, but felt that there were more able navigators among the latter. In North America probably only the Franklin's Gull has a true migration.

Just why there is a dispersal tendency in the Herring Gull, and why it is pronounced only in some first-year birds, is difficult to see. Lincoln (1939) thinks that the tendency, which he calls "migration," may be inherited by the individual as a "recessive character which it largely outgrows as it reaches maturity." He further suggests that it may represent vestigial migration. Possibly it should be called migration only in a very broad sense since its direction and timing may be largely due to external environmental factors. Perhaps the young birds do not really display *Zugunruhe* (as reviewed by Farner, 1950), but simply are not strongly attracted to the vicinity of the colonies. Perhaps natural selection favours those which do simply drift with the wind and eventually proceed to the south, for these avoid the harshness of winter with which, in their inexperience, they might not be able to cope. Later, when more experienced, they are also more sexually mature and many feel an attraction to the vicinity of the colony, even if this be just a rather broad vicinity. Once fully adult and breeding there may be less incentive to wander and more to return to the nesting sites early in the year—a tendency frequently found in colonies where the best (*i.e.* central) sites are occupied by the older birds (Fisher and Lockley, 1954).

MORTALITY

Some idea of the causes of death of the banded birds can be gained from the details usually submitted with the recovery reports, but equal significance cannot be given to all the recoveries. As Paynter (1947) has made clear, fates closely allied with human activities will be amply recorded, but birds killed by predators, disease and other causes will be recovered only by chance. He illustrates this, and to repeat his illustration using the figures from this study, 3.02% of the 1,127 recoveries for which data were furnished were caught by fishermen. This does not mean that 3% of all Michigan Herring Gulls meet this fate, for these 34 birds probably represent most such catches of the entire 37,414 banded. Thus the mortality rate due to this cause is more nearly 0.09%.

Listed herewith are the causes of mortality recorded for both the Michigan birds and Paynter's Kent Island birds. Of the latter group, 37,557 were banded as young. Recoveries of gulls which were banded as adults at Kent Island are not considered here.

Most birds are reported as "found dead." This category, and those of "found," and "killed," furnishes us with no information.

Some 13.84% of the Michigan birds recovered were captured in one way or another as compared with 14.76% of the Kent Island recoveries. Those Michigan birds reported as captured by fishermen were taken on a line, by a hook or in nets. A somewhat higher percentage of the

	Michigan			Kent Island		
	No.	Percent		Percent		
Found dead	693	61.49		53.51		
Captured and released	60	5.32		1.99	(during banding, not comparable)	
Captured	37	3.28	13.84% captured	9.02		
Captured by fishermen	34	3.02		4.31	14.76% captured	
Trapped	25	2.22		1.43		
Shot	85	7.54		5.35		
Injured, sick, or wounded	76	6.74		7.58		
Found	50	4.44		4.63		
Killed	24	2.13		2.14		
Band only	4	0.35		0.87	("band recovered" perhaps not comparable)	
Miscellaneous	39	3.46		3.17		
				2.71	(prob. found dead)	
Total	1,127	100%		1.19	(collected)	
No information	16			1.83	(no information)	
	1,143			100%		

marine Kent Island birds met this fate, but more of the inland Michigan birds were taken in animal (mainly muskrat) traps.

Of the 85 Michigan birds shot, 48 (56%) were in their first year (35 were shot before their first December 31st). Probably many of the recoveries reported as "found dead" really represent birds shot as the persons sending in the bands may have feared prosecution. European banding studies show much higher percentages of recoveries from shot birds (Drost and Schilling, 1940, record 51.2% shot and 34.5% found dead, Paludan, 1953, 60.4% shot and 30.8% found dead), along with correspondingly fewer birds recorded as found dead.

The three recoveries given as "band only" are instances in which a band has been picked up in a field or on a shore perhaps after being lost by the bird which bore it. Paynter's category "band recovered" is probably not comparable. I have lumped all recoveries of birds reported as "injured," "sick" or "wounded" because of the likelihood that the person finding the bird was unable to distinguish which was the case.

The miscellaneous group is worthy of mention. Included here are two birds which were shot, one for a specimen and one, a four-year-old, at a state fish hatchery. Two were reported as killed by owls, and one by an eagle (Paynter records two as killed by eagles). Losses to animal predators include one killed by a "fox or coyote," one by a dog, and one killed "probably" by a mink. It is to be expected that the number of recoveries from such sources will give a very incomplete picture of the actual predation rates. Three were hit by automobiles, three by trains, and one died in a collision with a jet aircraft at an airbase. Of Paynter's similarly sized sample eight deaths resulted from collisions with aircraft, eight with automobiles, and one with a train. Two birds, reported as being "tame," were "picked up," and a first-year bird was taken when it flew into a porch. Two birds were found exhausted, six frozen, two drowned, and one with oil on its plumage. Not all of these diagnoses, of course, are necessarily correct, and some, such as a bird found "paralyzed" and one which died of "lead poisoning," leave considerable doubt as to the cause of death.

One report of considerable interest, however, tells of a four-year-old gull which pecked at its leg until the band fell off. Although a certain amount of forcible removal shortly after banding might be expected, this seems to indicate that some birds at least do not become accustomed to wearing bands. Paynter (1949), is of the opinion that loss of bands by wearing and breaking probably is not great in the Herring Gull, at least up to ten years of age, since many bands survive ten years in good condition. Recall, however, that in three cases bands of Michigan gulls were found lying in fields or on beaches, and bands found on nesting islands have not been considered. These birds had been banded one, six, and eight years before the bands were found. If the bands did not wear through and fall off, then either the birds themselves removed them or the bands were separated from the birds' carcasses by some agency. The number of instances in which these isolated bands are found can certainly give no idea of how many are lying on beaches and fields, as they are much less likely to be found than are dead gulls. If, then, many Herring Gulls do remove their bands, older age groups will yield proportionately fewer returns than younger, but the extent of the bias thus introduced, if, indeed, such a bias does exist, is unknown. This bias could be partly responsible for the failure to reconcile attempted calculations of mortality rates and longevity with known productivity rates on the basis of North American banding recoveries (reviewed by Farner, 1955).

The remaining recoveries are likely unusual instances: a bird was found "stuck in [an] asphalt bed" in Mexico, another flew into the cargo hold of a freighter, one became caught between two timbers on a dock, one broke its wing by flying into a ship's life line, while one in Chicago was killed when it flew into a flagpole. Finally, in the course of feeding one took poisoned corn and one "choked on a fish."

The oldest bird yet recovered in this group was a 19-year-old found dead by the Ludwigs in 1954 on Bellow Island, Lake Michigan, where they had banded it in 1935. It may be the oldest Herring Gull yet recovered in North America. A Herring Gull banded in Denmark in 1925 and recorded just over 28 years later is claimed by Bergstrom (1956) to have set a new longevity record for any species in the wild. Captive Herring Gulls, however, have reached considerable ages. Pearson (1935) records a captive pair which attained 49 and 45 years of age, and Flower (1938) one which reached at least 41 years.

I have already mentioned that mortality is highest among first-year birds and stated that 63.34% of the recoveries in this study were of that age group, 42.16% of the total being before December 31st. This feature has been common to all the banding studies of Herring Gulls in Europe as well as in North America referred to previously in this paper and to studies of other species of gulls. Paynter (1947) has suggested that first-year birds are relatively weak. Lack (1943) shows that the number of first-year Black-headed Gulls, *Larus r. ridibundus*, which are shot is disproportionately higher than for older birds. He suggests that they become "warier and harder to shoot as they get older." Later (Lack, 1946) he suggested on the basis of recoveries from a number of species that the higher mortality among juvenile birds is due to general inexperience.

SUMMARY AND CONCLUSIONS

1. Between 1931 and 1957 Mr. Claud C. Ludwig and his two sons banded 37,414 juvenile Herring Gulls in colonies in the Great Lakes adjacent to Michigan. The 1,143 recoveries are analyzed herein.
2. Dispersal begins in late summer and early autumn. Most birds in their second year or older tend to remain on the shores of the Great Lakes within 300 miles of the colony.
3. There is some evidence of a northward tendency in the early autumn, but recoveries from sparsely-settled northern Ontario and Quebec are too few to characterize it properly.
4. First-year birds, particularly in the period between January 1st and June 30th, fly farther than older birds. There is great individual variation in the distances they cover, however, and in the time they quit the vicinities of the colonies.
5. Recoveries are most frequent from the shores of the Great Lakes. Other recoveries fall into two categories: (1) the Mississippi River and its tributaries, and (2) the Atlantic and Gulf of Mexico coasts. Access to the Atlantic coast is probably mainly *via* the St. Lawrence River.
6. Waterways and coasts are followed because they provide a source of food, and it is suggested that they function further to supply lanes of upward air currents used in soaring. This contention finds support in the literature at least to the degree that numerous other soaring species make use of thermal lanes during migration.
7. Prevailing winds probably are a major factor in controlling the direction taken by the gulls, that is, they superimpose a direction upon the dispersal. This direction coincides with autumn movement down the Great Lakes-St. Lawrence system, a winter movement to the south down the Mississippi or the East coast, and spring return northward. Many other birds are known to use tail winds extensively or exclusively on migration, thus it is likely that a soaring species such as the Herring Gull would follow suit. Since many Herring Gulls are relatively sedentary, though, it is quite possible that a condition of *Zugunruhe* is not typical of the movements of the species. These movements, then, should perhaps not be considered as migratory, but merely as a wandering governed directly by environmental factors. It is possible that immature birds are less attracted to the vicinity of the breeding grounds than are sexually mature birds.
8. The most westerly inland recoveries in the study are probably cases of young birds returning home in the spring and taking a western tributary as they move up the Mississippi. They do not represent a tendency to disperse to the west.
9. The southward movement of late December, characteristic only of first-year birds, carries the gulls on the East coast to Georgia and Florida and rarely into the West Indies. It also takes other birds from the Great Lakes down to the Gulf of Mexico, a concentration occurring in Texas and Louisiana. Quite a few reach Mexico, and there is one record from Honduras and one from Nicaragua.
10. In 1936 a much larger number of first-year birds reached the western part of the Gulf of Mexico than in any other year of the study. No reason for this movement has been offered herein.
11. A relationship between colony of birth and place of recovery exists to the extent that relatively more birds born in Lake Huron colonies are recovered in Ontario than in Wisconsin, Illinois and Indiana, the opposite being the case for birds born in Lake Michigan colonies. Since dispersal is originally for short distances and is probably largely on the lake of birth, and since mortality is highest among the youngest gulls, this is not really surprising. It is reflected to a lesser degree in the winter movement to the south, since Lake Huron gulls, of which more have drifted east, provide relatively more East coast and fewer Gulf of Mexico recoveries than do Lake Michigan gulls. Colonies vary individually in the degree to which they are characteristic of colonies in their lake as a whole.
12. Twenty Herring Gulls banded by the Ludwigs and three by other banders were recovered in the breeding colonies. Thirteen of these were recovered in the colony where banded and ten in other colonies (one actually in another

lake). These indicate both return to the colony of birth, and, if they were breeding birds, some exchange between colonies which would reduce genetic isolation.

13. Other published banding studies of Herring Gulls breeding in the Great Lakes show similar dispersals, as do those of birds banded on the East coast, although the latter do not wander inland to any extent. European studies reveal dispersal of short distances, usually in all directions and often confined to the coasts. Again, it is the young birds which do most of the wandering, and environmental factors may largely control what directional tendencies there are.
14. Many of the same dispersal tendencies are evident in related *Larus* species. Erratic dispersal of first-year birds, with great individual variation, followed by some degree of drifting usually without a fixed migration pattern, while the adults largely remain relatively close to the breeding colonies is apparently characteristic of most of the group.
15. Over half of the birds recovered were listed as "found dead." The next highest categories were of birds captured, usually by fishermen or muskrat trappers, of birds shot, and of injured, sick, or wounded birds. One very interesting case of a band recovery came after the person submitting the report watched the gull, a four-year-old, remove the band from its leg by pecking at it. This observation introduces the consideration that if such action is not infrequent, then a bias exists in the recoveries of older birds that will be difficult to calculate.
16. Mortality is greatest in first-year birds up to December, the rate declining rapidly thereafter.

REFERENCES CITED

Airway meteorological atlas for the United States. 1941. U. S. Dept. Commerce, Weather Bureau, Wash., D. C.

ALLEN, ROBERT P., and ROGER T. PETERSON. 1936. The hawk migrations at Cape May Point, New Jersey. *Auk* **53**: 393-404.

ALLEN, WILLIAM H. 1948. Bird migration and magnetic meridians. *Science* **108**: 708.

BAKER, O. E. 1936. Atlas of American agriculture. Physical basis including land relief, climate, soils and natural vegetation of the United States. U. S. Dept. Agric., Wash., D. C.

BARTHOLOMEW, J. G., A. J. HEIBERTSON, and A. BUCHAN. 1899. Bartholomew's physical atlas, III. Atlas of meteorology. Roy. Geographical Soc., The Geographical Inst., Edinburgh.

BENNETT, HOLLY REED. 1952. Fall migration of birds at Chicago. *Wilson Bull.* **64**: 197-220.

BENT, A. C. 1921. Life histories of North American gulls and terns. Bull. U. S. Nat. Mus. 113. 333 pp.

BERGSTROM, E. ALEXANDER. 1956. Extreme old age in birds. *Bird-Banding* **27**: 128-129.

BROLEY, CHARLES. 1947. Migration and nesting of Florida Bald Eagles. *Wilson Bull.* **59**: 3-20.

BROOKS, MAURICE. 1952. The Allegheny Mountains as a barrier to bird movement. *Auk* **69**: 192-198.

BROUN, MAURICE. 1939. Fall migrations of hawks at Hawk Mountain, Pennsylvania, 1934-1938. *Auk* **56**: 429-441.

——— 1951. Hawks and the weather. *Atlantic Nat.* **6**: 105-112.

Climatological Data. (Issued monthly). U. S. Dept. Com., Weather Bureau, Wash., D. C.

COFFEY, B. B., JR. 1943. Post-juvenal migration of herons. *Bird-Banding* **14**: 34-39.

COOKE, WELLS W. 1910. The migratory movements of birds in relation to weather. Yearbook of Agriculture. U. S. Dept. Agric., Wash., D. C., : 379-390.

——— 1913a. The relation of bird migration to the weather. *Auk* **30**: 205-221.

——— 1913b. Distribution and migration of North American herons and their allies. U. S. Dept. Agric. Biol. Surv. Bull. 45. 70 pp.

DALQUEST, WALTER W. 1951. Frigate Bird crossing Isthmus of Tehuantepec. *Condor* **53**: 256.

DEELDER, C. L. and L. TINBERGEN. 1947. Waarnemingen over de vlieghoogte van trekkende vinken, *Fringilla coelebs* L., en spreeuwen, *Sturnus vulgaris* L. (Eng. summ.). *Ardea* **35**: 45-78.

DENNIS, JOHN V. 1954. Meteorological analysis of occurrence of grounded migrants at Smith Point, Texas, April 17-May 17, 1951. *Wilson Bull.* **66**: 102-111.

DENNIS, JOHN V. and LEE JAY WHITTLES. 1955. The riddle of fall migration on Nantucket. *Bull. Mass. Aud. Soc.* **39**: 319-324, 385-394.

DEVLIN, JOSEPH M. 1954. Effects of weather on nocturnal migration as seen from one observation point at Philadelphia. *Wilson Bull.* **66**: 93-101.

DOBBEN, W. H. VAN. 1953. Bird migration in the Netherlands. *Ibis.* **95**: 212-234.

DROST, R. 1929. Ueber Vogel wanderungen in den Winter-monaten. Zugleich ein Beitrag zum Kapitel 'Vogelzug und Winterung.' Verh. VI. Int. Orn. Kongr. 62-79.

DROST, R. and L. SCHILLING. 1940. Ueber den Lebensraum deutscher Silbermowen, *Larus a. argentatus* Pontopp., auf Grund von Beringungsergebnissen. *Vogelzug* **11**: 1-22.

EATON, RICHARD JEFFERSON. 1933. The migratory movements of certain colonies of Herring Gulls. Part I. *Bird-Banding* **4**: 165-176.

———— 1934. Parts II and III. *Bird-Banding* **5**: 1-19, 70-84.

FARNER, D. S. 1950. The annual stimulus for migration. *Condor* **52**: 104-122.

———— 1955. Bird-banding in the study of population dynamics. *In* Recent studies in avian biology. U. of Ill. Press, Urbana. 198-237.

FERGUSON, A. L. and H. L. FERGUSON. 1922. The fall migration of hawks as observed at Fishers Island, N. Y. *Auk* **39**: 488-496.

FERRIS, REED W. 1940. Eight years of banding of Western Gulls. *Condor* **42**: 189-197.

FISHER, JAMES. 1954. Bird recognition. I. Penguin Books, London. 191 pp.

FISHER, JAMES, and R. M. LOCKLEY. 1954. Sea-birds. Collins, London. 320 pp.

FLOWER, S. S. 1938. Further notes on the duration of life in animals. IV. Birds. *Proc. Zool. Soc. London*, Ser. A. **108**: 195-235.

FORSTER, G. H. 1955. Thermal air currents and their use in birdflight. *Brit. Birds* **48**: 241-253.

GOODWIN, DEREK. 1949. Notes on the migration of birds of prey over Suez. *Ibis* **91**: 59-63.

GRIFFIN, D. R. 1943. Homing experiments with Herring Gulls and Common Terns. *Bird-Banding* **14**: 7-33.

GROSS, A. O. 1940. The migration of Kent Island Herring Gulls. *Bird-Banding* **11**: 129-155.

INGRAM, COLLINGWOOD. 1919. Notes on the height at which birds migrate. *Ibis*, 1919: 321-325.

KENDREW, W. G. 1953. The climates of the continents. Oxford, Clarendon Press. 607 pp.

LACK, D. 1943. The age of some more British birds. *Brit. Birds* **36**: 193-197, 214-221.

———— 1946. Do juvenile birds survive less well than adults? *Brit. Birds* **39**: 258-264.

LANDSBERG, H. 1948. Bird migration and pressure patterns. *Science* **108**: 708-709.

LEACH, E. P. 1944. Scandinavian Herring Gulls in Scotland and Lincolnshire. *Brit. Birds* **37**: 159.

LINCOLN, F. C. 1928. The migration of young North American Herring Gulls. *Auk* **45**: 49-59.

———— 1939. The individual vs. the species in migration studies. *Auk* **56**: 250-254.

LINCOLN, F. C. 1950. Migration of birds. U. S. Dept. Int., Fish and Wildlife Ser. Circ. 16. 102 pp.

LOCKLEY, R. M. 1942. Shearwaters. J. M. Dent. London. 238 pp.

LOWE, FRANK A. 1954. The heron. Collins, London. 177 pp.

LOWERY, G. H., JR. and ROBERT J. NEWMAN. 1955. Direct studies of nocturnal bird migration. *In* Recent studies in avian biology. U. of Ill. Press, Urbana. 238-263.

LUDWIG, FREDERICK E. 1942. Migration of Caspian Terns banded in the Great Lakes Area. *Bird-Banding* **13**: 1-9.

———— 1943. Ring-billed Gulls of the Great Lakes. *Wilson Bull.* **55**: 234-244.
MACKINTOSH, D. R. 1949. The use of thermal currents by birds on migration. *Ibis* **91**: 55-59.
MAYR, E. 1952. German experiments on orientation of migrating birds. *Biol. Rev.* **27**: 394-400.
MATTHEWS, G. V. T. 1952. An investigation of homing ability in two species of gulls. *Ibis* **94**: 243-264.
MCCREARY, O. 1934. The shifting of the route of migrating birds due to wind. *Auk* **51**: 255-256.
MCMILLAN, N. T. 1938. Birds and the wind. *Bird-Lore* **40**: 397-406.
MENDALL, HOWARD L. 1939. Food habits of the Herring Gull in relation to fresh-water game fishes in Maine. *Wilson Bull.* **51**: 223-226.
MITCHELL, CAPT. K. D. G. 1955. Aircraft observations of birds in flight. *Brit. Birds* **48**: 59-70.
MOREAU, R. E. 1953. Migration in the Mediterranean area. *Ibis* **95**: 329-364.
MORTENSEN, H. CHR. C. 1950. Studies in bird migration. Being the collected papers of H. Chr. C. Mortensen 1856-1921. Ed. Poul Jespersen and Å. Vedel Tåning. Dansk. Ornithol. Foren.
MUNK, HOLGER. 1951. Dansk stormmagers *(Larus canus* L.) traek. (The migration of Danish Common Gulls.) (Eng. summ.) *Dansk Ornithol. For. Tidsskr.* **45**: 192-196.
OTTERLIND, G. 1948. On the food habits and distributional ecology of the Herring Gull. (Eng. summ.) *Fauna och Flora.* 1948: 116-137.
PALUDAN, K. 1953. Nogle resultater of Københaus Zoologiske Museums ringmaerkning af *Lurus argentatus.* (Eng. summ.) *Vidensk. Medd. dansk. naturh. Foren. Kbh.* **115**: 181-204.
PAYNTER, R. A., JR. 1947. The fate of banded Kent Island Herring Gulls. *Bird-Banding* **18**: 156-170.
———— 1949. Clutch-size and the egg and chick mortality of Kent Island Herring Gulls. *Ecol.* **30**: 146-166.
PEARSON, T. G. 1935 A Herring Gull of great age. *Bird-Lore* **37**: 412-413.
PIMLOTT, D. H. 1952. The economic status of the Herring Gulls of the Grand Manan Archipelago, New Brunswick, 1949. Wildlife Serv. Wildlife. Mgm't. Bull., Canada Ser. 2, vol. 5: 1-76.
POOR, HUSTACE H. 1943. Color-banded immature Herring Gulls in the New York Region. *Bird-Banding* **14**: 101-115.
———— 1944. Color-banded adult Herring Gulls. *Bird-Banding* **15**: 112-114.
RUDEBECK, G. 1950. Studies on bird migration—based on field studies in southern Sweden, *Vår Fågelvärld,* Suppl. 1: 1-148 (cf. *Ibis* 1951, **93**: 481-482.)
———— 1951. The migration of birds of prey in southern Sweden, particularly at Falsterbo. Proc. Int. Orn. Cong. 10. Upssala, 1950: 317-319.
SMITH, FRANK. 1908. A migration flight of Purple Martins in Michigan in the summer of 1905. *Wilson Bull.* **20**: 41-43.
SPARK, R. 1951. The food of North-European gulls. Proc. Int. Orn. Cong. 10, Upssala, 1950: 588-591.
STEWART, PAUL A. 1952. Dispersal, breeding behavior, and longevity of banded Barn Owls in North America. *Auk* **69**: 227-245.
STANFORD, J. K. 1953. Some impressions of spring migration in Cyrenaica March-May 1952. *Ibis* **95**: 316-328.
SUFFERN, C. 1949. Pressure patterns in bird migration. *Science* **109**: 209.
THOMSON, A. LANDSBOROUGH. 1924. The migration of the Herring Gull and the Lesser Black-backed Gull: results of the marking method. *Brit. Birds* **18**: 34-45.
THOMSON, A. LANDSBOROUGH. 1936. Recent progress in the study of bird migration. A review of the literature, 1926-35. *Ibis,* 13th series: 472-530.
———— 1953. The study of the visible migration of birds: An introductory review. *Ibis* **95**: 165-180.
TINBERGEN, NIKO. 1953. The Herring Gull's world. Collins, London. 255 pp.
WALLACE, GEORGE J. 1948. The Barn Owl in Michigan. Mich. State Coll., E. Lansing, Tech. Bull. 208.
WILLIAMSON, K. 1952. Migrational drift in Britain in autumn 1951. *Scot. Nat.* **64**: 1-18.
WITHERBY, H. F., F. C. R. JOURDAIN, N. F. TICEHURST and B. W. TUCKER. 1941. The handbook of British birds. V. Witherby, London.

WOODBURY, A. M., W. H. BEHLE, and J. W. SUGDEN. 1946. Color-banding California Gulls at Great Salt Lake, Utah. Bull. Univ. Utah, Biol. Ser. 10: 1-15.
WOODBURY, A. M. and HOWARD KNIGHT. 1951. Results of the Pacific Gull color-banding project. *Condor* **53**: 57-77.
WOODCOCK, A. H. 1940. Herring Gull soaring. *Auk* **57**: 219-224.
———— 1942. Soaring over the open sea. *Scientific Monthly* **55**: 226-232.

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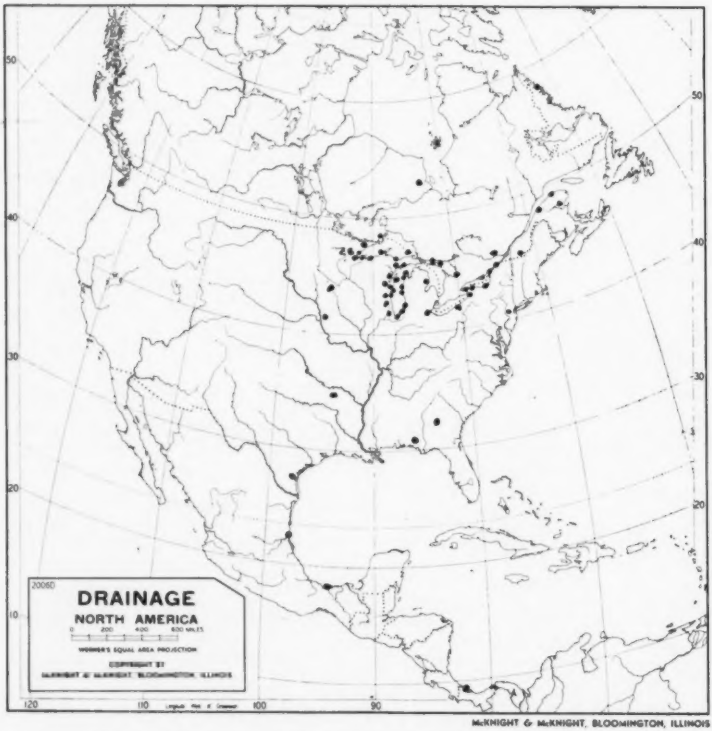
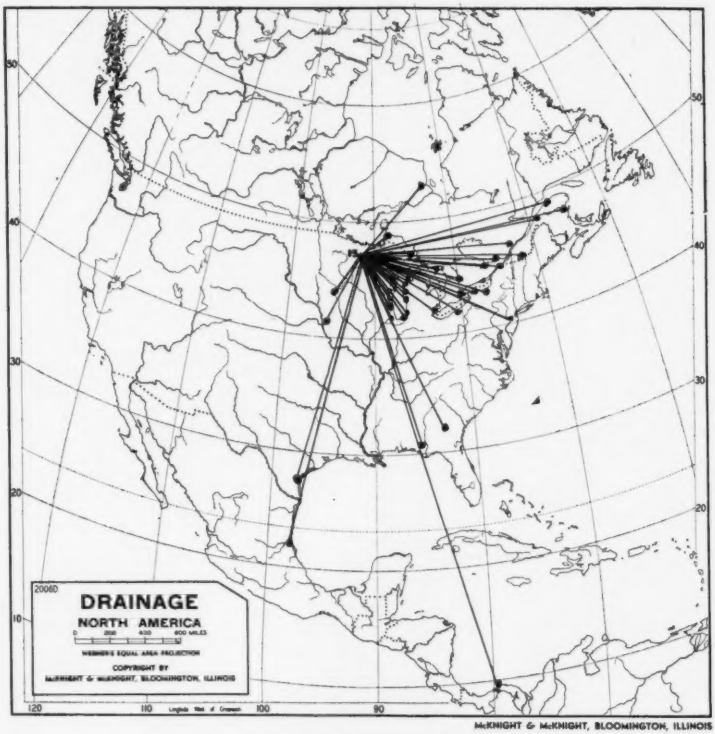
FALL MIGRATION OF HERRING GULLS FROM KNIFE ISLAND, MINNESOTA

By P. B. HOFSLUND

In June, 1950 the Duluth Bird Club began a banding study of a colony of Herring Gulls *(Larus argentatus)*. This study has continued each summer since, the summer of 1957 marking the eighth year. The present paper deals with the recoveries of banded gulls up to May 15, 1958.



Map 1. Recoveries of Herring Gulls banded as nestlings on Knife Island, Minnesota.



Map 2. Recoveries of first-year Herring Gulls.

The breeding site is a small island in Lake Superior, roughly 800 x 300 feet at its longest and widest spots. It lies less than a half mile from the mouth of Knife River in Lake County, Minnesota, and is known, at least locally, as Knife Island. Much of the island is covered with Mountain Ash *(Sorbus americana)* with a scattering of Balsam Fir *(Abies balsamea)*, Balsam Poplar *(Populus balsamifera)*, and a tangle of undergrowth. The periphery, however, is largely bare rock, and it is here that most of the nests are located. One notable exception was a nest placed approximately 18 feet up in a Balsam Fir.

Census reports (Hofslund, 1952:162) for the years 1948-'52 showed nest counts varying between 150 and 312. Though no actual counts have been made since 1952, it is likely that the island now supports in excess of 250 breeding pairs each year. In recent years the only other nesting birds found on the island have been a pair of Red-breasted Mergansers *(Mergus serrator)*. Passerine birds are conspicuous by their absence.

Banding operations have been confined to an afternoon, usually on the second weekend in June. There has been an attempt to work

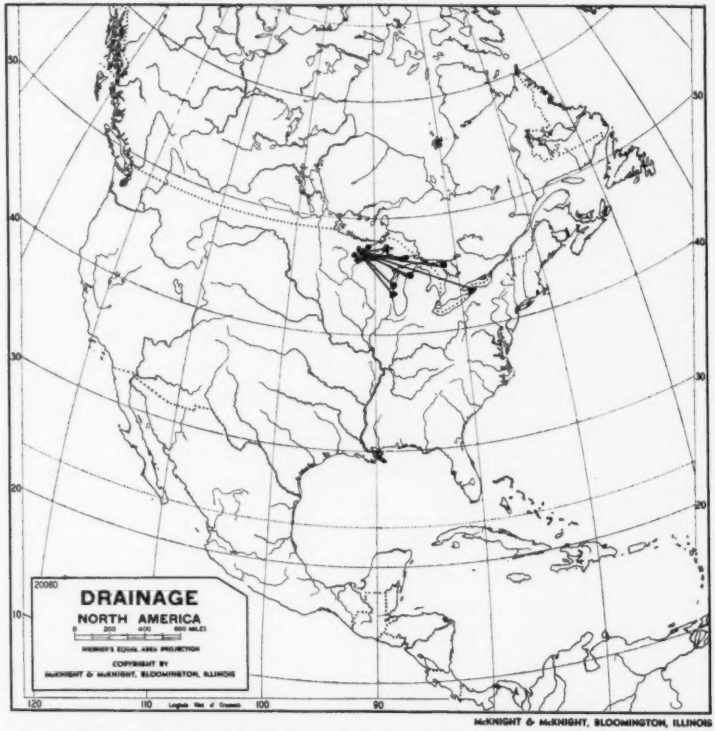
Map. 3. Recoveries of second-year Herring Gulls.

as swiftly and efficiently as possible with a general limit of 500 bands so as to minimize the disturbance of the colony. Despite this, some young birds have been killed by adults or have met death in other ways associated with the disturbance, and more than likely, most of the birds recovered in June of the year they were banded never survived the day of banding.

A total of 3,028 nestling gulls have been banded since the project started. We have received 81 reports of recoveries or 2.67% of the total banded. While not a large number, the recoveries reveal certain patterns in the movements of the gulls after they leave Knife Island.

Lincoln (1928:59) and Gross (1940:153) described the dispersal of gulls from their breeding grounds as "explosive," a conclusion well-founded on the basis of recoveries from banding sites in Lake Michigan and at Kent Island. The present study was started in part to determine whether this explosive nature of the dispersal was apparent only where ready access to large waterways was available.

The following points are pertinent to the discussion of the results of the study:



Map 4. Recoveries of adult Herring Gulls banded as nestlings on Knife Island.

1. The majority of the recoveries of Knife Island Gulls come from the Great Lakes. Of the 81 recoveries only 12 have not been from areas intimately associated with the Great Lakes-St. Lawrence Waterway.

2. Only two of the 12 records are from areas north of this waterway, the rest are south.

3. Of the 10 southerly records all but three are associated with the Atlantic, Gulf of Mexico, or Caribbean Sea coastlines.

4. The three records not associated with coastal waters are on or near major tributaries of the Mississippi River, and the dates of recovery (Table 1) suggest that these birds were continuing their wandering northward toward the breeding grounds rather than having reached these points through a southerly dispersal over land.

5. If we now turn our attention to the distribution maps (Maps 2, 3, and 4), it is apparent that the wandering tendency is lessened as the gulls reach breeding age, a conclusion previously brought out by others (Gross, 1940:136), and in the case of Knife Island gulls their travels seem to be confined largely to the Great Lakes.

6. There is a lack of uniformity in distances travelled by gulls of

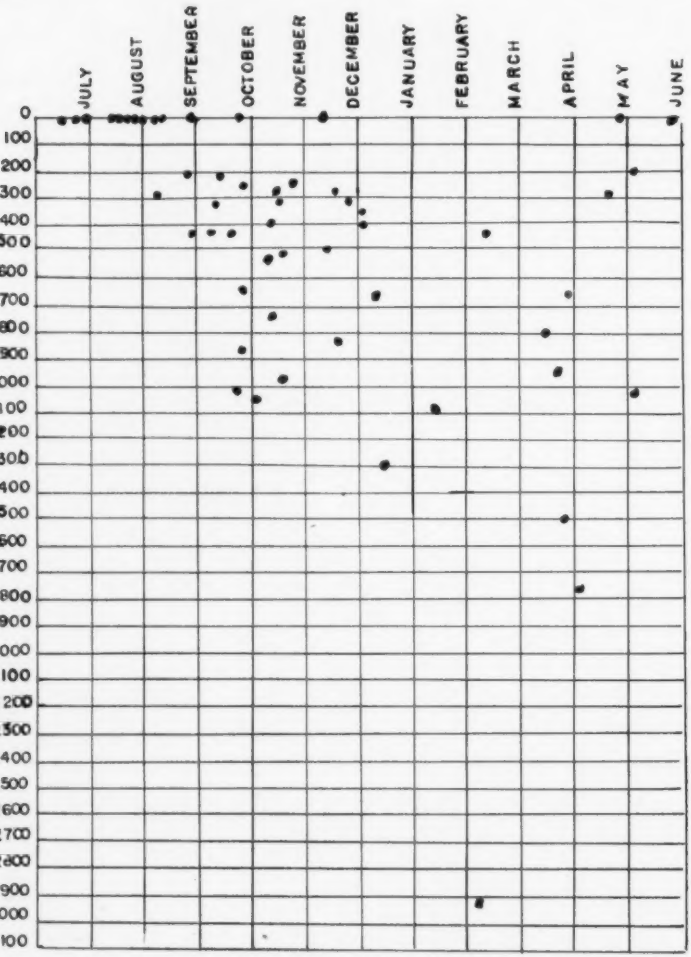


Figure 1. Scattergram showing distances from banding point to place of recovery of first-year birds.

the same age as is shown by the scattergrams (Figures 1, 2, and 3). An extreme example would be the two first-year birds recovered in February, one of which had wandered about 450 miles while the other had covered nearly 2,950.

7. Gulls banded at Kent Island off the coast of New Brunswick (Gross, 1940:137) were largely recovered along the Atlantic coast. Only a very few were found away from coastal waters.

8. Gulls banded by Lyon and Wilson (Gross, 1940:139) and those discussed by Lincoln (1928) were banded mostly in Lake Michigan. These showed a dispersal in all directions.

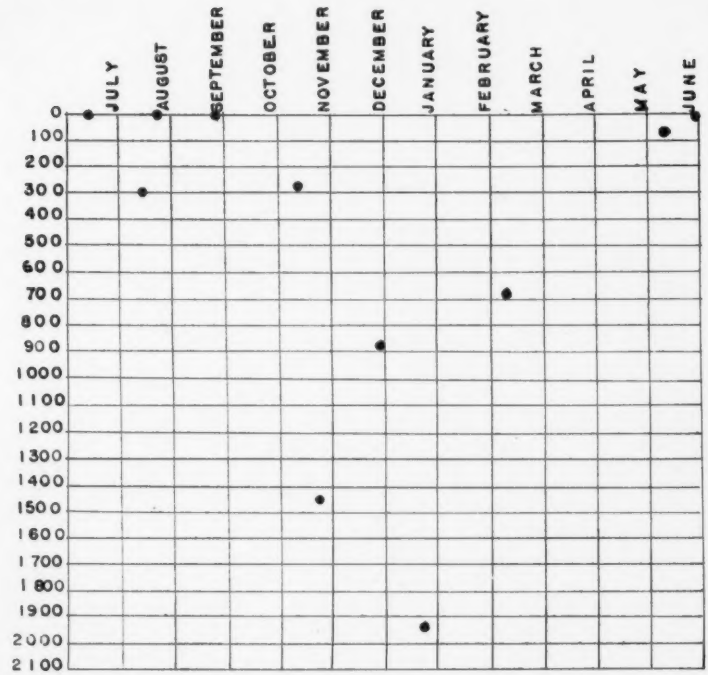


Figure 2. Scattergram showing distances from banding point to place of recovery of second-year birds.

9. The report of the Pacific gull-banding project (Woodbury and Knight, 1951) showed almost a strict adherence of Pacific gulls to coastal waters.

These points bring me to the conclusion that the term "explosive dispersal" is not suitable to describe the fall migration of Herring Gulls, but rather should be called a wandering whose directional tendencies are determined by the availability of large waterways. The explosive quality is effectively blocked by the lack of shore or coastlines.

The tendency to move southward after the first of the year as suggested by Lincoln (1928:56) and Gross (1940:153) also seems to me as not being an applicable general assumption. From the distribution of the records along the coastlines it appears that the only major southward movement comes from gulls that have reached the coastline. Once the coastline was reached the availability of food and the major water traffic would exert a positive force in a southerly direction. Major shipping lines might have some effect on this and also might determine to some extent the distances that individual gulls might travel. The concentration of records along the southern shores of the Great Lakes indicates that there are factors favoring such a distribution, one of which might be that the major ports of call of the

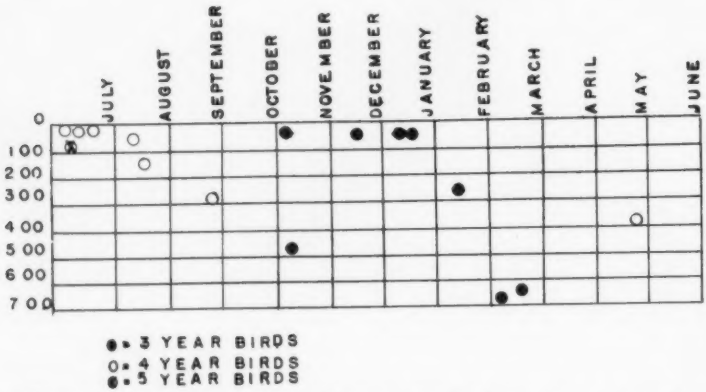


Figure 3. Scattergram showing distances from banding point to place of recovery of those birds that reached their third, fourth, or fifth year of age.

iron ore ships would be in these areas. An observer on Lake Superior can see concentrations of young gulls following some of these ships as they move away from and toward the shipping centers at Duluth and Two Harbors in late August.

Causes of death and the mortality rate are much as have been found in other gull studies. At least two-thirds of the mortality occurs before the Herring Gull has reached one year of age. The usual report is that the bird was "found dead," but several more detailed records, such as "brought home by the cat," "killed going over Niagara Falls," "landed in an oil pit," etc., are given in Table 1.

TABLE 1

RECOVERIES OF GULLS BANDED ON KNIFE ISLAND

Date Banded	*Recovered At*	*How Found*	*Date Recovered*
June 17, 1950	Burlington, Ontario	Brought home by cat	Dec. 9, 1950
	½ mile from Duluth	Found dead on highway	April 23, 1951
June 16, 1951	Marinette, Wisconsin	Landed in oil pit	Aug. 28, 1951
	Big Muskego Lake, Wisc.	Brought to museum for identification	Nov. 23, 1951
	Tampico, Tamaulipas, Mexico	Captured alive	April 5, 1952
	Pneuforbee Creek, 8 miles N. Tuskegee, Ala.	Found dead	May 3, 1952
	Coatzacoalcos, Vera Cruz, Mexico	Found, probably dead	Dec. 15, 1952
	West River, shore of Beaver Island State Park, Grand Island, New York	Found dead in water	Feb. 8, 1953
	Lake Kagawong, Manitoulin Island, Lake Huron	Found dead, may have been shot	Oct. 5, 1953
	Duluth, Minnesota	Found dead	June 7, 1954

June 14, 1952	Lake Superior, Duluth	Found dead	June 14, 1952
	Duluth, Minnesota	Drifted to shore	June 24, 1952
	Duluth, Minnesota	Found dead, badly decomposed	July 13, 1952
	Knife River, Minn.	Found dead	Aug. 24, 1952
	Manitoulin Island, Meldrum Bay, Altoma, East County, Ontario	Found	Sept. 8, 1952
	Massawippi Lake, Ayer's Cliff, Stanstead County, Quebec	Killed	Sept. 22, 1952
	Elmvale, Simcoe, Ont.	White diarrhea	Oct. 9, 1952
	Manistee, Michigan	Found dead	Oct. 18, 1952
	West Twin River, Two Rivers, Wisc.	Found dead	Nov. 16, 1952
	St. Maurice River, Laviolette County, Que.	Caught in fox trap	Nov. 20, 1952
June 14, 1952	Wilson, Niagara County, New York	Found dead	Mar. 31, 1953
	Jay Township, Dunnell, Martin County, Minn.	Found with a broken wing. Died	April 24, 1953
	Pentwater, Oceana County, Michigan	Found dead	July 10, 1953
	Pungnivik, 10 miles So. of Nain, Labrador	Found	Oct. 1953
	Marble Lake, Lake County, Minnesota	Found dead with fishplug in mouth	May 15, 1954
	Mouth of Brule River, Douglas County, Wisc.	Found in fishermen's net	May 28, 1954
	4 miles West of Sand Island off Bayfield County, Wisconsin	Caught in float nets, released in good health	Nov. 18, 1954
	Niagara Falls, Welland County, Ont.	Killed going over Niagara Falls	Feb. 27, 1955
	Two Harbors, Minn.	Found dead	June 13, 1955
	Mouth of French River, St. Louis County, Minn.	Found dead	July 7, 1955
	Point Beach, Two Rivers, Wisconsin	Found dead	April 28, 1956
	Knife Island, Lake County, Minnesota	Found dead	June 8, 1957
June 29, 1953	St. Joseph, Michigan	Found dead	(5 weeks from) Sept. 28, 1957
June 12, 1954	Oscoda, Iosca County, Michigan	Found dead	Sept. 19, 1954
	Betsie Bay, Frankfort, Benzie County, Mich.	Found dead	Sept. 23, 1954
	Lake Erie, Ashtabula, Ohio	Found dead	Sept. 25, 1954
	Des Prairies, Bizard Island, Laval County, Quebec	Found	Sept. 27, 1954
	1 mile S.E. Woodstock, McHenry County, Ill.	Found dead	Dec. 2, 1954
	Beach at Michigan City, Indiana	Found dead	Feb. 9, 1955

June 12, 1954	Oswego, N. Y.	Found dead	Mar. 14, 1955
	Corpus Christi, Texas	Found sick, band removed	Mar. 22, 1955
	Knife Island, Minn.	Leg found	June 11, 1955
	Bad River, 10 m. E. of Ashland, Wisc.	Found dead	Oct. 1956
	Superior, Wisc.	Found dead	Dec. 10, 1956
	Superior, Wisc.	Found dead	Dec. 10, 1956
	West Kewaunee, Kewaunee, Wisc.	Trapped and released	Jan. 17, 1957
	Burlington Beach, Two Harbors, Minn.	Found dead	June 16, 1957
	East Shore of Kewaunee Peninsula, Mich.	Found dead	July 8, 1957
	Lake Superior between Munising and Marquette, Mich.	Found dead	Aug. 24, 1957
June 11, 1955	Between Two Harbors and Duluth, Minn.	Found dead	June 22, 1955
	½ mile east Knife River, Lake Cty., Minn.	Found dead	July 18, 1955
	Lester River, Duluth, Minn.	Found dead	July 19, 1955
	5½ m. S. Two Harbors, Minn.	Found dead	Aug. 10, 1955
	Turkey Island, Detroit River, Ontario	Found dead	Oct. 20, 1955
	Black Cape, New Richmond, Bonaventure Cty., Gaspe Peninsula, Quebec	Caught in fox trap	Dec. 14, 1955
	Lake Manawa, Lewis Twp., Pottawattamie County, Iowa	Found dead	May 27, 1956
	12 m. E. Duluth, Minn.	Hit by a car	Aug. 21, 1956
	3 m. from Ford R., Mich.	Found dead	May 3, 1957
	East Beaver Bay, Silver Bay, Lake Cty., Minn.	Found dead	May 24, 1957
June 9, 1956	17 m. N. Duluth, Minn.	Found dead	Aug. 8, 1956
	Sleeping Bear Bay, Leelanau Cty., Mich.	Found dead	Sept. 12, 1956
	Riviere du Loup, Quebec	Found dead	Oct. 5, 1956
	Shore of Ottawa River, 4 m. W. Ottawa, Quebec	Found dead	Oct. 10, 1956
	Grand Beach, Mich.	Found dead	Oct. 12, 1956
	Ste. Flavic, ½ way between Grand Metis Bay and Mont Gali (Mt. Joli?) airport, Que.	Found dead	Oct. 18, 1956
	Attawapiskat River, 50 m. N. of Ogoki, Ont.	Shot	Nov. 1956
	Flood Bay, Two Harbors, Minn.	Found dying	Nov. 10, 1956

	Duluth, Minn.	Found dead	July 16, 1957
	1 m. N. Camp Huan, 8 m. N. Sheboygan, Wisc.	Found dead	July 16, 1957
	Danville, Arkansas (2½ m. W.)	Found dead	Nov. 28, 1957
June 8, 1957	Duluth, Minnesota	Found dead	July 24, 1957
	Duluth, Minnesota	Found dead (shot)	July 25, 1957
	Big Caribou Island, Ontario	Found dead	Aug. 8, 1957
	Escanaba, Mich.	Found dead	Sept. 14, 1957
	Park Point, Duluth, Minn.	Found dead	Sept. 21, 1957
	S. Shore Lake Winnebago, ¼ m. N. E. Fond du Lac, Wisc.	Found dead	Oct. 1957
	Black Bay, Lake Superior, Ontario	Noted	Oct. 25, 1957
	Lockport, Ill.	Found dead	Dec. 3, 1957
	Macon, Georgia	Found dead	Jan. 12, 1958
	Bay at Bocas del Toro, Panama	Caught on fish hook	Feb. 7, 1958
	State Fish Hatcheries, Hackettstown, N. J.	Shot	Mar. 23, 1958

Greatest wandering, as has been mentioned before, takes place during the first year, and there seems to be a tendency even among these first-year birds to turn toward their hatching place as the breeding season approaches. Very few apparently winter near the breeding grounds; we have only one recovery from less than 100 miles during the winter, and despite the fact that several thousand gulls winter along the North Shore and though we have examined flocks very carefully, we have yet to find more than one banded bird in the flocks. Whether this was a native bird we do not know.

SUMMARY

3028 nestling gulls have been banded on Knife Island, Lake County, Minnesota, from 1950 to 1957. 81 recoveries have been received.

The general tendency is for the gulls to move to the east at the end of the breeding season, following the shorelines of the Great Lakes-St. Lawrence Waterway. Explosive dispersal seems to be effectively stopped by the lack of suitable waterways.

The tendency to move south seems to be limited to those birds which reach the coast.

Wandering is greatest in non-breeding birds, but there is a tendency even among them to return to the breeding grounds at the beginning of the next breeding season.

Mortality is highest in first-year birds. Causes of death where detailed are listed.

LITERATURE CITED

GROSS, ALFRED O.
1940 The migration of Kent Island Herring Gulls. *Bird Banding* **11**: 129-155.

HOFSLUND, P. B.
1952 1952 census of Knife Island. *Flicker* **24**: 162-63.
LINCOLN, FREDERICK C.
1928 The migration of young North American Herring Gulls. *Auk* **45**: 45-59.
WOODBURY, ANGUS M., and HOWARD KNIGHT
1951 Results of the Pacific Gull color-banding project. *Condor* **53**: 57-77.

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ANTARCTIC ORNITHOLOGICAL STUDIES DURING THE IGY

By CARL R. EKLUND

Exploration and research stimulated by the International Geophysical Year have been primarily concerned with the physical sciences. The United States National Committee for IGY and similar committees of other countries recognized, however, the unique opportunity for research in the life sciences in the remote polar regions. Because IGY personnel were encouraged to make such studies at Antarctica stations, it was my privilege to do ornithological work while serving as Scientific Leader at Wilkes Station during 1957-58.

None of the countries participating in the IGY employed ornithologists. Except for a zoologist and an ichthyologist assigned to the USSR Mirny Station, no full-time biologists of any type were at work in Antarctica. Fortunately, most stations had personnel with training in the biological sciences who were sufficiently interested to conduct studies incidental to their primary duties.

As we enter the post-IGY period, it is gratifying that the Polar Research Committee of the National Academy of Sciences has recognized a continuing need for Antarctic research in the life sciences. A Panel on Biology and Medical Science has been functioning as part of that Committee; on its recommendation, funds have been granted for ornithological work.

My purpose in this paper is to report ornithological studies conducted during the IGY at seven United States stations and, upon the basis of recent contact with foreign countries having Antarctica stations, to list their studies in this field.

In the fall of 1956, through the USNC-IGY, I initiated a study on the distribution and life history of the South Polar Skua *(Catharacta maccormicki)*. Relatively little has been known of the habits and movements of this most southerly of all birds, which in January, 1958, was observed by Sir Edmund Hillary within 80 miles of the South Pole.

The main phase of the study required the banding of a representative number of skuas. Eight nations, including Argentina, Australia, Japan, New Zealand, Norway, USSR, the United Kingdom, and the United States, participated in making this one of the most internationally cooperative bird studies ever conducted. The normal numbered metal bands were used and, for the first time, a 1½-inch-wide colored thermoplastic band also was used. A different color denoted each of eighteen banding stations in Antarctica. This enabled ready field

identification of the birds' migratory patterns, without requiring capturing the bird.

Banding of approximately 1,500 skuas at Antarctic stations has been reported thus far. Interesting returns already have been received from Australia on migrations to that continent, and from the Belgians, Russians, and Americans on skua movements within Antarctica.

Many life-history data on the skua have been obtained, covering nesting and other breeding habits, non-reproductive behavior, mortality, populations, and local and seasonal movements. Temperatures of incubating skua as well as Adelie Penguin *(Pygoscelis adeliae)* eggs were taken continuously for a nine-day period, using an electronic telemeter inside the eggs. Used for the first time in such research, this instrument transmitted a series of pips, or pulses, the rate of which was governed by changes of temperatures within the egg. A low-frequency radio receiver was "tuned in" on the broadcasting egg; pulses were then relayed into a Decade Counter and recorded by the observer. Pulses were calibrated with known temperatures. The penguin egg maintained an average temperature of 92.7° F., the skua 96.6° F. (Eklund and Charlton).

New techniques provided information on effect of color on other birds, and on daily and seasonal movements. Thirty Adelie Penguins were dyed yellow, while 180 skuas were dyed yellow, or scarlet, or were sprayed with one or a combination of colored enamels. Skua chicks were dyed in the eggs. The survival rate of colored versus unmarked chicks yielded interesting data on the effects of protective coloration. Marked skuas were flown to the South Pole Station for release in homing experiments.

Studies at United States stations included a survey of birds of the Windmill Islands in Vincennes Bay, site of the Wilkes Station. Seven species nest and four others occur in the area. During the survey, a detailed population study was made of the sixteen Adelie Penguin rookeries located on these islands. Forty-nine birds, representative of eleven species, were collected here for the United States National Museum.

Prior to the IGY, during the Antarctic summer of 1955-56, Austin (1957) banded more than 500 Adelie Penguins at Cape Bird and Cape Royds on Ross Island in McMurdo Sound, and at Cape Hallet in Victoria Land. He also banded some skuas and Giant Fulmars at these areas. At Cape Hallett, location of the joint United States-New Zealand IGY Station, we had to remove all Adelie Penguins from within a measured two-acre site needed for construction of the camp. We took 7,850 penguins from this area. This figure, when applied to the total 55 acres covered by the rookery, would indicate a population of over 215,000 birds.

Banding of skuas is being continued at the various stations. In addition, funds have been granted by the Polar Research Committee for an Adelie Penguin behavior study to be conducted at the Wilkes Station by Mr. Richard Penney, a University of Wisconsin graduate student. This station is to be taken over from the United States by Australia. Banding of the Giant Fulmar *(Macronectes giganteus)* will also be carried out there by Mr. Penney, Dr. W. J. L. Sladen of Johns

Hopkins University, and Australian personnel as a continuation of an extensive banding program of this species inaugurated in the late 1940's by Australia and the United Kingdom at sub-Antarctic Islands and Palmerland.

Through its Falkland Island Dependencies Survey (FIDS), the United Kingdom organized a banding project in 1947, and more than 7,200 birds of seventeen species in the Antarctic or sub-Antarctic have been banded through the 1956-57 nesting season at bases in Palmerland (Sladen and Tickell). Primary emphasis has been on penguin banding in behaviorism studies initiated by Sladen, and on Giant Petrel banding. More than 2,000 of the latter species have been "ringed" and this, together with similar work being done by the Australians at several sub-Antarctic islands, has shown a round-the-world movement by this large bird. Extensive banding of all species is being continued at FIDS bases to study local and seasonal movements, longevity, and life-history habits.

Another study is being carried out at a FIDS base by Mr. W. L. N. Tickell on the Life History and Behavior of the Dove Prion *(Pachyptila desolata)*. Observations were made during IGY on the life cycle of the Emperor Penguin *(Aptenodytes Forsteri)* at the British Base at Halley Bay in the Weddell Sea.

Ornithological work at Australian Antarctic bases during the IGY, in addition to skua banding, consisted primarily of Emperor Penguin mortality studies made by Dr. R. L. Wilting, station doctor at Mawson. His findings were related to the population, topography and weather. Feeding habits were also studied.

In 1957-58 Australia's Davis Station workers mapped the distribution of breeding birds in the Vestfold Hills. During the Antarctic summer of 1958-59 the breeding habits of the Snow Petrel *(Pagodroma nivea)* are being studied at the Mawson Station. Australia's Giant Petrel banding program, which has yielded much interesting data on movements, is also continuing at Macquarie Island, an IGY station in the sub-Antarctic (Ingham).

Observations on the ecology of Adelie Penguins were made at the Japanese Syowa Station, and museum collections were obtained of local birds (Nagata).

A faunal inventory was carried out by Soviet IGY scientists on land and sea areas in the Antarctic and sub-Antarctic from 1955-58. More than 600 ornithological collections representative of eleven species were brought back, including 170 food-habit specimens, and 332 birds of all species were banded. Primary work was done by Syroechkovski, Korotkevich, Kirpichnikov and Macushok. Most of the work was conducted at Haswell Island, near their main base at Mirny, and at a satellite station in Bunger Hills (Lapina).

Materials collected are now being studied at institutions in the USSR. These include a comparative osteological examination of several penguin species, systematic work on the Emperor Penguin, and studies of the anatomy and functional morphology of various Antarctic bird species. Soviet ornithologists are preparing a monograph on the birds of Antarctica.

Syroechkovski (1957), zoologist at the Mirny Station during 1956-57, conducted detailed bio-geographical and ecological studies at Haswell Island. He prepared a zoo-geographic map on a scale of 1:50,000, showing species distribution on the island, and obtained data on populations, feeding habits, parasitism, and breeding behavior. Five zones in his bio-geographic studies included the Antarctic ice shield; lands isolated from the sea, such as the Bunger "oasis"; the "mature Antarctic oasis" or cold desert, having a connection with the sea; littoral islands; and sub-Antarctic islands.

The Soviets believe that a broad discussion of questions concerning birds of Antarctica is desirable, and suggest a symposium pertaining to the problems be held at an International Ornithological Congress. Such a discussion is needed.

Prior to IGY six Emperor Penguin rookeries had been located in Antarctica, and existence of another was suspected in the Weddell Sea area. The known rookeries included Cape Crozier in the McMurdo Sound area at longitude 169° E., the first ever discovered; the Dion Islet rookery off the west coast of Palmerland, south of Adelaide Island, where the British conducted the first detailed studies of the species; a rookery near Gaussberg in King Wilhelm II Land at longitude 89° E. reported by the Germans; the Point Geologie rookery in Adelie Land at longitude 140° E. which was studied by the French; the Haswell Island rookery at longitude 92° E. discovered by Mawson in 1915; and a rookery at Taylor Glacier on MacRobertson Coast at longitude 61° E. reported by the Australians in 1955 (Eklund). Known population figures for all these rookeries totaled less than 40,000 birds.

The Cape Crozier rookery, found in 1902 by Dr. Edward Wilson of the British National Antarctic Expedition, was visited by New Zealand scientists in September 1957 (Balham). It had shifted position somewhat from its original location on the sea ice and had about 1,000 adult birds, approximately five times the estimated population 50 years earlier.

During the IGY five new Emperor Penguin rookeries were discovered by the Australians, bringing to six the known number between longitudes 55° E. and 80° E. Two other rookeries were found in the Weddell Sea area at Halley Bay and Gould Bay, numbering 21,000 and 8,000 birds respectively. These discoveries confirmed earlier reports of the presence of breeding birds.

Another Emperor Penguin nesting area, with the largest population found to date, was discovered from a helicopter in December 1958 by Captain John Cadwalader of the United States Navy and Mr. John Dearborn, a biologist at Stanford University. Located approximately 250 miles north of McMurdo Sound at latitude 73° S., longitude 169° E., between Coulman Island and Lady Newness Shelf Ice, the rookery contained an estimated 50,000 birds. Known Emperor Penguin rookeries now number fourteen, with an estimated population of more than 135,000.

With official recognition of the life sciences by the International Council of Scientific Union's Special Committee on Antarctic Research (SCAR) in a continuing post-IGY Antarctic program, it is hoped that long-range ornithological studies can be conducted. Much remains to

be done in this region, and it is hoped that ornithologists will lend interest, support, and guidance to the program. This can be accomplished through the Polar Research Committee Panel on Biology and Medical Science of the National Academy of Sciences.

REFERENCES

AUSTIN, OLIVER L., JR. 1957. Notes on banding birds in Antarctica, and on the Adelie Penguin colonies of the Ross Sea Sector. *Bird-Banding*, **27**: 1-26.

BALHAM, ROGER. Personal correspondence. Research Section, Wildlife Div., New Zealand Dept. Int. Affairs, Wellington, N. Z. Dec. 1958.

EKLUND, CARL R. 1956. Antarctic fauna and some of its problems, in Antarctica in the International Geophysical Year. Geophysical Monograph No. 1, Am. Geophys. Union, Nat'l. Acad. Sci., Wash., D. C., publ. No. 462, pp. 117-123.

——— and CHARLTON, FREDERICK E. 1958. Measuring the temperatures of incubating penguin eggs. Research Reviews, Office of Naval Research, USN, Wash., D. C., pp. 1-6. Dec. Reprinted in *Amer. Scientist*, **47**(1): 80-86, March, 1959.

INGHAM, SUSAN E. Ornithological work at Australian Antarctic Stations. Personal correspondence, Bio. Secr't. ANARE, Dept. Ext. Affairs, Melbourne, C. 1., Victoria, Australia, Oct. 22, 1958.

LAPINA, I. J. A short summary of ornithological work conducted by Soviet scientists in the Antarctic from 1955-58. Personal correspondence, Sci. Secr't., Soviet Ant. Comm., M. Haritonyevsky 4, Moscow, TSENCR, USSR.

NAGATA, TAKESI. Ornithology and general biology in Japanese Ant. Res. Expeds. Personal correspondence, Secr't. Japansese NCIGY, Geophys. Inst. Tokyo U., Tokyo, Japan. Oct. 16, 1958.

SLADEN, W. J. L., and TICKELL, W. L. N. 1958. Antarctic bird-banding by the Falkland Islands Dependencies Survey, 1945-1957. *Bird-Banding*, **29**: 1-26.

SYNOCCHKOVSKI, Y. Y. 1958. Geographic investigations in the Antarctic. Izv. Acad. Sci. (Geograph. Series), Moscow, No. 6: 163-169.

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GENERAL NOTES

Orientation of Gannets*.—The first real advance in the study of bird orientation was made after the Second World War, when Gustav Kramer of the Max Planck Institute at Wilhelmshaven in West Germany discovered that Starlings were able to choose a definite direction, using only the sun and no visible horizon. His later experiments showed that pigeons could be taught to feed at the same compass direction, regardless of time of day; then that the pigeon's "clock" could be shifted through several hours but could not be speeded up or slowed down. The birds "knew" there were twenty-four hours in a day; they would not subscribe to any longer or shorter working hours. Kramer's first publications were in German, but his work has been summarized in English (Kramer 1952, 1957).

A number of theories by which birds may use the sun to navigate have been proposed, presuming the birds can decide where they are and where their homing goal is. These controversial theories are perhaps best summarized in Matthews' (1955) *Bird Navigation*, and by Kramer (1957) (but see also Allen, 1956). Bird navigation, which assumes actual knowledge of location both of the wanderer and his home, differs from orientation which assumes only that the wanderer can establish definite compass directions, not that the bird knows where it is or where its home is.

For recent comprehensive reviews of homing experiments, before and after Kramer's first discovery, see Griffin (1952, 1955). One of Griffin's own experiments was to release Gannets *(Sula bassana)* near the center of Maine and to follow them with a light aeroplane. It was presumed that these Gannets were "looking" for home. The few birds he was able to follow for a considerable distance seemed to be using an expanding search pattern. An expanding search pattern starts from a point and extends out from it as a helix, keeping the same point as center.

Many of us who have spent time at sea have been impressed with the decisiveness with which seabirds take up a direction when they are flying over the sea. My experiences during World War II in trying to run an expanding search pattern indicated that remarkably accurate orientation should be credited to Gannets if they can run an expanding search pattern. For these reasons, some observations that I made on June 9, 1956 while traveling on the Royal Dutch ship *Groote Beer* bound for Southampton, England, seem to be worth publishing.

The weather was warm, wind west at about ten knots, sky overcast, and the sun could be seen as a spot through the clouds for two- to five-minute periods in each half hour. At 0800 local time the ship's position was about 80 nautical miles bearing 195° True from Fastnet Rock, on the southwest corner of Ireland. At 1115 the ship was about 70 nautical miles bearing 175° True from Fastnet. The ship's course was 093° True.

At 0800, 65 Gannets in groups of three to eight birds were seen flying, one behind the other, on a course which wavered slowly between 010° and 025° True. Between 0800 and 0930 I saw about 150 Gannets. At 0930 the Gannets' course was wavering between 005° and 010° True. A loose group of 11 Gannets, in single file, was seen at 1030, and these birds were flying due north. At 1115 20 Gannets, in single file, were seen flying along a course between 350° and 355° True. After 2:00 p.m., local time, the overcast was complete and 6 Gannets in three groups of 2 were flying erratically over the ocean.

My interpretation of these observations is that as the ship passed by Fastnet's gannetry, it crossed the paths being followed by Gannets returning home from their fishing grounds. When our position was plotted on the chart, and a direction taken to Fastnet, at each period the Gannets were headed directly toward the Rock.

It seems clear from these observations that the Gannets had a "picture" of the true homing direction, although it certainly is not clear whether these were actually homing in the sense that a displaced homing pigeon can return, or whether they had kept subconscious track of their wanderings and so were operating on "dead reckoning."

LITERATURE CITED

ALLEN, WILLIAM H. 1956. Bird Navigation (review of Matthews). *Bird-Banding* **27**: 48-50.

GRIFFIN, D. R. 1952. Bird Navigation. *Biological Reviews* **27**: 359-393.

———— 1955. Bird Navigation (in Recent Studies in Avian Biology, Univ. of Illinois Press, pp. 154-197).

KRAMER, G. 1952. Experiments on Bird Orientation. *Ibis* **94**: 265-285.

———— 1957. Experiments on Bird Orientation and their Interpretation. *Ibis* **99**: 196-227.

MATTHEWS, G. V. T. 1955. Bird Navigation. Cambridge University Press.

*Contribution from the Hatheway School of Conservation Education No. 12.

WILLIAM H. DRURY, JR., Hatheway School of Conservation, Drumlin Farm, South Lincoln, Mass.

Egg teeth and hatched shells of various bird species.—The deciduous calcareous denticle that erodes the egg shell in the process of hatching is remarkably uniform in most of the hundred bird species hatched and examined. It is characteristically situated on the upper mandible a few millimeters from the tip. Since the apex of the bill in most species is slightly decurved, and in hawks, owls and parrots greatly decurved, the egg tooth varies in its position relative to that point of reference. In all species examined, however, a line passing along the proximal part of the tomium transects the anterior base of the egg tooth regardless of the curvature of the culmen. In the ducks the egg tooth has a broad basal plate surmounted by a sharp spine, the cutting instrument; in most other species only the cone-like spine is to be found.

Peculiarities encountered in my examinations of species artificially incubated, spontaneously hatched, up to 1957, are as follows: No neonatal American Woodcock *(Philohela minor)* in my collection has an egg tooth. Whether the denticle is never present in this species, or whether it is unusually deciduous, is hard to say. As the woodcock is known to have sensory nerve endings in the bill, the absence of an egg tooth could be adaptively accommodating; but if so, the technique must be singular. The hatched shells did not attract our attention and were discarded; however, Dr. John Aldrich has called our attention to the

fact that Mendall and Aldous (The ecology and management of the American woodcock, 1943) describe the emergence of the downy young from a longitudinal slit on one side of the egg.

The egg tooth of the Rock Dove *(Columba livia)* is of the sort typical of other birds. It is noteworthy that the strongly prognathous lower mandible, whatever may be its reason for prognathism, is undoubtedly held in check from further evolutionary exaggeration by the mechanics of hatching. If it were any more prognathous, the present egg tooth could not gain purchase to the shell.

The Mourning Dove *(Zenaidura macroura)*, unlike the Rock Dove, is not prognathous at hatching. It has a typical egg tooth. But on the gonys there is a peculiar structure that resembles an egg tooth. The point of the structure, however, is directed posteriorly, as, indeed, the whole structure is well posterior to the apex of the bill so that it is difficult to understand how it could function.

The neonatal Yellow-shafted Flicker *(Colaptes auratus)* has the most peculiar egg tooth, or teeth, encountered. The flicker is prognathous. The tips of both mandibles have an extensive, thick, gleaming white covering that appears as if they had been dipped in enamel. On the lower mandible this covers the limited prognathous part. On the upper mandible it extends laterally along the tomium to half the distance to the external nares, and on the culmen extends as a ridge or keel to a point above the nares. The anterior part of the keel falls off precipitously at the locus of the anterior edge of the typical avian egg tooth. The Heinroths (Die Vogel Mitteleuropas, 1931) on plate 5 of volume 4 figure the very similar device of *Picus viridis*. The necessity for this armor is puzzling. The Heinroths (Die Vogel Mitteleuropas, 1924-1933) mention that the woodpeckers are supposed to have an "extremely altricial" condition of development at hatching. One could postulate that the relatively undeveloped bill requires the extra rigidity that the enamel-like covering affords. A further possibility could be elaborated on the basis of the prognathous condition of newly-hatched woodpeckers. (See discussion under Rock Dove, above.) The buttressing of the required higher "keel" and projecting cutting edge of the egg tooth may have been necessary to keep pace with the evolutionary differential growth of the lower mandible. Evolutionary caenogenetic emergence of the egg tooth of the lower mandible may have been the final resolution of the problem created by prognathism. Correlation of this peculiarity with a long neck (possessed by woodpeckers) is not applicable to herons (which are not prognathous).

The Downy Woodpecker *(Dendrocopus pubescens)*, the only other woodpecker examined, also prognathous at hatching, lacks the extensive enameling and has no lower egg tooth but the upper "keel" of the flicker is replicated.

Two further considerations warrant examination. The egg shells of the flicker are relatively thin; this fact would seem to pose problems in the whereabouts of minerals in the egg drawn upon for the formation of the enormous egg tooth. Secondly, as any peculiarity of a neonatal bird, and especially of a cavity nesting species, is bound to be assigned to parental "feeding releasers" by behaviorists, this possibility would seem to be pertinent in the flicker.

While it was anticipated that a many-species comparison of hatched egg shells would yield data on differences in hatching technique (Skutch, *Condor*, **59**: 217-229, 1957), such data did not materialize from our examinations of the collected hatched shells of more than a hundred species—with the probable exception of the eggs of the woodcock mentioned above. Some eggs had seeming peculiarities in the raggedness of the fracture, but in most cases the singularity was not consistent within the species. The geese, ducks and hawks had extremely jagged fractures, but this was related to the thickness of the shell in these large birds. The herons had relatively smooth and regular fractures.

The typical fracture in most species was serrate for about three-quarters of the circumference of the egg where the hatchling brought to bear its egg tooth; the remainder of the circle was either smooth or irregularly jagged where the shell finally hinged open by gross pressure from the inside of the egg. In no case was the line of cutting spiral or eccentric. The shell in practically every case was cut nearest the end of least concavity, never at the point of greatest circumference, but sporadically at the end of greatest concavity. The eggs of the Virginia Rail *(Rallus limicola)* hatched relatively closer to the large end, lifting a very small disk and leaving much of the shell intact. The air-cell, contrary to most accounts, was not always pierced in either the small or the

large species, whether hatched from the small end or the large end of the egg. The appearance of the fracture understandably led Porter (Friends in feathers, 1917) to believe erroneously that hatching of the Bobwhite *(Colinus virginianus)* is effected by external (parental) agency. The egg membranes of the hatched shell as they dry, contract, especially where cut by the egg tooth (Could "hatching enzymes" such as possessed by animals of other classes be involved?), pulling inward the loose fragments of shell and creating an apparent edge of external shear.—David Kenneth Wetherbee, Patuxent Research Refuge, U. S. Fish and Wildlife Service, Laurel, Maryland.

Some Leg Sizes and Band Sizes. Many data on leg sizes and band sizes have been tabulated by Blake *(Bird-Banding*, **25**: 11-16, **27**: 76-82, and **29**: 90-98) and Bergstrom *(Bird-Banding*, **25**: 58-59). The data in Table I represent information on species not covered by Blake and Bergstrom or species on which they had few data.

Table 1. Leg sizes and band sizes.

Species	Sample Size	Aver. Greater Diameter	Aver. Lesser Diameter	Band Size
Butorides virescens	1	7.7	3.6	6
Accipiter velox Im. ♂	16	3.3	2.3	2
Accipiter velox Im. ♀	12	4.1	3.1	3
Charadrius vociferus	16	2.8	2.0	1A
Actitis macularia	34	2.5	1.7	1B
Tringa solitaria	22	2.8	1.9	1A
Totanus melanoleucus	1	5.0	2.7	3A
Totanus flavipes	18	3.3	2.1	2
Erolia melanotos	1	2.5	1.8	1B
Erolia minutilla	29	1.7	1.3	0
Limnodromus griseus	1	3.2	2.2	2
Ereuntes pusillus	64	1.9	1.4	1
Empidonax flaviventris	8	1.5	0.9	0
Dolichonyx oryzivorus ♂	44	2.6	1.6	1A
Dolichonyx oryzivorus ♀	32	2.5	1.5	1A or 1B
Passerculus sandwichensis	17	1.8	1.1	0

The measurements were made with a "Blake" gauge and the recommended band sizes follow Table I in Blake *(op. cit.)*. J. Woodford and Frank T. Lovesy. c/o Royal Ontario Museum, Toronto 5, Canada, and 220 Gowan Avenue, Toronto, Canada.

More Recoveries of Massachusetts Robins.—Some of the Robins *(Turdus migratorius)* banded at our station in Groton and recovered elsewhere have been described in earlier issues of *Bird-Banding* (**24**: 5-6, **28**: 99). In addition to four recovered within 50 miles of Groton, we have had seven more Southern reports, as follows:

Age Sex	Month Banded	Month Recovered	Place Recovered
A ♂	June, 1953	November, 1954	Claxton, Ga.
im.	July, 1952	March, 1954	Whittier, N. C.
♀	July, 1952	December, 1955	Ocean Springs, Miss. — "shot"
im.	Sept., 1955	February, 1956	Whiteville, N. C.
♀	Sept., 1954	January, 1957	Savannah, Ga.—"caught by cat"
im.	July, 1956	January, 1958	Plant City, Fla. — "shot"
im.	July, 1957	February, 1958	Hogansville, Ga.

— William P. Wharton, Groton, Mass.

White-Throated Sparrow Wintering Dates at Baltimore.—In the northwestern suburbs of Baltimore, an area just above the Fall Line, the White-throated Sparrow *(Zonotrichia albicollis)* arrives in late September or early October and is then seen until about mid-May; for the period 1951-1957 my extreme dates are September 27 and May 17. Observation of some color-banded

birds indicates, however, that the individuals which actually spend the winter here do not arrive until late October and early November—some even later than that, perhaps—and that they leave from late March to late April; my extreme dates for such marked birds 1951-1957 are October 19 and April 29.

During 1951-1957 I banded 120 White-throats, and used color bands on 51 of them. The original trapping dates of color-banded birds that wintered about my home were October 21, November 5, 8, 11, 12, 14, 19, 27, December 5, 16, January 1, February 12. The dates on which color-banded return birds were first seen were October 19, 24 (two), December 20. The dates on which color-banded winterers were last seen were March 22*, 31, April 13, 14, 19, 21 (two), 22, 23 (two), 24, 27, 29; the bird marked * may have been present to April 8.

Although the dates from November 27 on seem late for actual arrivals, and no doubt represent at least some birds that arrived earlier but were not promptly trapped (of course it is not assumed that *any* bird was trapped on the very day of its arrival), it may be noted that fall migrants as late as December 20 are reported for Maryland by Stewart and Robbins (Birds of Maryland and the District of Columbia, North American Fauna No. 62, 1958: 366-368); they also report spring migrants as early as March 5.

The longest stay I have recorded for a color-banded winter resident is 183 days—from October 24, 1954, to April 24, 1955. Some other stays have been 135, 156, 162, 165, and 169 days.—Hervey Brackbill, 2620 Poplar Drive, Baltimore 7, Maryland.

Migration of Breeding American Robins at Baltimore.—Observation of color-banded Robins *(Turdus migratorius)* at Baltimore, Maryland, from 1942 through 1958 has yielded some information on the movements of those that breed in a part of the city just above the Fall Line. The data come from 55 birds that were present from 1 to 6 years.

My dates indicate that the first males return before the first females, and that the majority of males return before the majority of females; however, some females return before some males. The two sexes seem to leave at the same time. The longest stays I have recorded were made, by both sexes, in the warm year 1951: a male was present February 13-October 4, which is 234 days; a female was present March 9-October 20, which is 226 days. Some other stays have been: males, 201, 202, 214, 220 (two birds), 222 days; females, 205, 209, 225 days.

Sixty-three first sightings of return breeders have ranged from February 13 to April 28; the peak period of returns has been March 6 to April 7. Twenty-two dates obtained during periods of daily search for returned birds, and so believed to be precise, are: 10 males, February 13 to March 20; 12 females, March 7 to April 5. A return bird has twice been the first Robin of the year; some other return birds have appeared during the first few days of migration.

Thirty-seven last sightings of breeding birds have ranged from September 5 to October 31; the peak period of last sightings has been October 2-20. Fifteen final dates believed to be precise are: 7 males, September 28 to October 17; 7 females, September 28 to October 20; one bird of unknown sex, October 31.

Each year some of my color-banded Robins disappear in July and August and are unfindable later despite much searching; I have 40 "final" dates in those months. Presumably, though, these birds have merely secluded themselves especially well during the molt, for the ones I have recorded into September and October have stayed until they then completed their change of plumage. Invariably, the latest departure dates are yielded by birds that are accustomed to visit my window feeding shelf daily. Stevens *(Bird-Banding,* **23**: 168-169, 1952) similarly reports his latest dates, of "about October 15-20" at Fargo, North Dakota, obtained from regular feeding shelf visitors.

Three Robins that I have banded have been recovered at a distance. One nestling, banded May 23, 1949, was "trapped, probably near New Orleans, La."; the letter reporting this to the Fish and Wildlife Service was dated January 29, 1950. Another nestling, banded May 21, 1952, was "caught" at Delraida, Alabama, a suburb of Montgomery, on February 5, 1954. The spots at which these two birds were hatched were only 65 yards apart; the bird caught in its first winter was 200 miles farther southwest than the second-winter bird. An adult male color-banded August 29, 1946, and not seen again was found dead at Roper, North Carolina, on March 6, 1947.—Hervey Brackbill, 2620 Poplar Drive, Baltimore 7, Maryland.

Remating Percentage of Some Migratory Birds.—In Baltimore from 1942 through 1957 I color-banded both members of 66 pairs of 9 species of migratory birds. The table below gives the return and remating record of these birds through 1958, in this wise: the first line means that 23 pairs of Robins were color-banded; both members of 10 pairs returned; only the males of 7 pairs returned; only the females of 3 pairs returned; neither member of 3 pairs returned; there was one remating.

	Pairs	Returns				Re-matings	Uncertain Rematings
		Both	Male	Female	Neither		
Robin *(Turdus migratorius)*	23	10	7	3	3	1	
Catbird *(Dumetella carolinensis)*	15	1	4	3	7	1	
Song Sparrow *(Melospiza melodia)*	11	1	3	0	7	0	1
Wood Thrush *(Hylocichla mustelina)*	5	0	3	1	1	0	
Rufous-sided Towhee *(Pipilo erythrophthalmus)*	4	2	0	0	2	1	
Brown-headed Cowbird *(Molothrus ater)*	4	2	0	0	2	2	
House Wren *(Troglodytes aëdon)*	2	0	0	0	2	0	
Mockingbird *(Mimus polyglottos)*	1	1	0	0	0	1	
Great Crested Flycatcher *(Myiarchus crinitus)*	1	0	1	0	0	0	
Totals	66	17	18	7	24	6	1

My 6 rematings out of 17 "pair returns" equals 35 percent of the possibilities; if the uncertain remating was a fact, 7 rematings out of 17 possibilities is 41 percent. Nice (Studies in the Life History of the Song Sparrow II, *Trans. Linn. Soc. N. Y.*, 1943, **6**: 182-183) had 8 Song Sparrow rematings out of 30 cases in which mates were present 2 years in succession: 27 percent. Kendeigh (Territorial and Mating Behavior of the House Wren, *Ill. Biol. Mon.*, 1941, **18**: 56) had 11 House Wren rematings out of 26 pair returns: 42 percent.

I have nothing to add to my 1952 note on the Robin *(Auk*, **69**: 465-466) regarding the circumstances of rematings or failures to remate. My listing of the Mockingbird as a migratory species is explained by my note in *Bird-Banding*, 1956, **27**: 128. —Hervey Brackbill, 2620 Poplar Drive, Baltimore 7, Maryland.

RECENT LITERATURE

BANDING

(See also numbers 16, 17)

1. 8th Annual Report of the Ornithological Society of New Zealand Ringing Committee. F. C. Kinsky, 1958. *Notornis*, **8**(1): suppl. 1-30. According to this report for the year ending 31 March 1958, the 37 New Zealand cooperators banded 5,803 birds of 46 species, and obtained 852 recoveries and 1,395 repeats. The number of recoveries seems remarkably high until one notes that included in that category are returns to the place of banding. On just what basis the New Zealanders differentiate between such returns and repeats is not apparent. As their activities increase they will doubtless find it useful, as other programs have, to classify their accumulating data more accurately, to list repeats, returns, and recoveries of short time and distance as totals only, and to give complete raw data only for the more significant distance recoveries and long-time returns.

Mr. M. Fitzgerald reports success in attaching light-reflecting plastic tape in several colors to the bands he uses on Wekas, a largely nocturnal rail. He found bands so colored "were easily recognisable at night time by the

use of a pocket torch for a distance of over 30 yards." The report also complains of "noticeable" wear of larger bands (5, 6, 7, 8) used on sea birds and adds "A new approach will be made to the manufacturers in the U.S.A. in an effort to rectify this matter." We hope their efforts in this direction will be more successful than ours have been for the past 3 decades.—O. L. Austin, Jr.

2. Activity at the Ottenby Bird Station 1957. (Report No. 23.) (Verksamheten vid Ottenby fågelstation 1957. (Meddelande nr 23).) Bengt Danielsson. 1958. *Vår Fågelvärld*, **17**: 177-201. (English summary.) This account marks Ottenby Bird Station's 11th year of banding activities and migration observations. Bill and wing measurements were added to this year's work. Only twice previously has the total of 12,679 birds banded in 1957 been surpassed. There were 139 recoveries. Extensive tables, maps of recoveries, photographs of rare species and the night migration of swans complete this report of the fine ornithological work being done at the Swedish bird stations.—Louise de K. Lawrence.

3. Bird-Banding in Finland in 1956. (Die Vogelberingungen in Finnland im Jahre 1956.) Göran Nordström. 1958. *Memoranda Societatis pro Fauna et Flora Fennica*, **33**: 69-108. More than 200 volunteer cooperators raised their annual banding total some 6,000 over the previous year to 30,937 birds of 149 species. The 551 recoveries of 79 species contain some fine long-distance ones, mostly from South Africa, and one of a 24-year *Larus ridibundus*.—O. L. Austin, Jr.

4. Bird-Banding in 1954 and 1955. (Prstenovanje ptica god. 1954. i 1955.) Renata Kroneisl-Rucner. 1957. *Larus*, **9-10**: 7-33. Jugoslavian banders under the auspices of the Ornithological Institute at Zagreb banded some 20,000 birds of 127 species in the 2-year period, almost half of them as nestlings. Though these have yielded a few good records, mostly from South Africa, more than half the 250 "recoveries" listed are actually repeats and returns of little significance. The 103 foreign-banded birds taken in Jugoslavia, for which full data are given, came mostly from various parts of the USSR and adjoining satellite countries, with a few from Finland and Sweden.—O. L. Austin, Jr.

5. Results of Bird-Banding in Belgium in 1957. (Résultats du Baguage des Oiseaux en Belgique (Exercice 1957).) R. Verheyen. 1958. *Gerfaut*, **48** (3): 215-253. The Belgian banding reports would be a great deal more informative if they gave the numbers of each species banded, and much more usable if in listing their recoveries they used the standard symbols advocated by Dr. W. Rydzewski in *The Ring*, endorsed by the International Committee for Bird Ringing, and now used in almost all other countries. Dr. Verheyen once pointed out (*Ring*, **1** (2): 17) that to satisfy Belgian banders they have "to publish practically every report on a ringed bird." This so clutters their lists with insignificant local recoveries and short-term repeats and returns that sorting the wheat from the chaff is difficult. Short summaries indicating the more interesting and significant results would add greatly to these unnecessarily detailed reports.—O. L. Austin, Jr.

MIGRATION

6. The Invasion of Waxwings 1956-1957. (Invasionen av sidensvansar (*Bombycilla garrulus*) 1956-1957.) Göran Hansson and Lars Wallin. 1958. *Vår Fågelvärld*, **17**: 206-241. (English summary.) This is another significant contribution to the knowledge of the "invasion type of bird migration," a careful and comprehensive analysis of the recent irruption of Bohemian Waxwings into Fenno-Scandia and other surrounding countries. It is based on a wealth of data contributed by reliable ornithologists from Petchoro-Ilytschk and Archangel in the northeast of European Russia to the British Isles in the west, from northernmost Sweden and Finland to Hungary in the south. Svärdson in his paper "The 'invasion' type of bird migration" (*Brit. Birds*, **50**: 314-343) had predicted an irruption of Waxwings in this year and he based his forecast on the probability

of an abundance of red berries in the fall of 1956 following the unusually warm summer of 1955. While the abundance of berries did occur in certain areas outside the Waxwings' usual breeding grounds and may, to some extent, have influenced the birds to move west (if they "knew" about it in some way), the study clearly shows that with this the whole story is far from told. From the analysis of the birds' movements, carefully mapped and discussed, a variety of factors seem to emerge, which either stopped the flights of the birds, or pushed them onwards, or influenced the direction in which they flew. Most significant among these were: 1) the *lack* of berries (winter food) in the east; 2) the migration drive within the birds aroused by this circumstance; 3) population density (indicated by the extended breeding areas in 1956); 4) leading lines of land and sea. Indeed, from reading this account, rather one gets the impression that the abundance of berries, such as happened this year in most of the regions west of Russia, played a comparatively small role in "enticing" the birds to fly west. Actually, the finding of the rowanberry bonanza here appears more or less fortuitous, assisted by the recurring awakening of the birds' migratory impulse coinciding with or even maybe conditioned by the fluctuations of the plant growth. Hence the authors are reluctant to accept too "strictly schematized" hypotheses about any single cause for irruptions of this kind and they urge that each immigration of species dependent on specialized winter foods be analysed separately, taking all the possibilities into account, if we are to know the full truth about them.—Louise de K. Lawrence.

7. Notes on the autumnal migration 1957 at the Bosporus. (Fågelsträcket vid Bosporen några höstdagar 1957.) Torgny von Wachenfeldt. 1958. *Vår Fågelvärld*, **17**: 201-206. (English summary.) So far Turkey is virgin land from the standpoint of ornithology. Work is greatly hampered by the suspicious attitude of the police, which entails the difficult and time-consuming job of securing various permits to protect the bird-watcher against undue interference.

Chiefly storks and raptors compose the migratory flocks that cross the Bosporus, flying in an easterly and southeasterly direction. The first storks appear by the middle of August. In concentrations of up to 10,000, the large black and white birds hover over Istanbul during the "stork days." The migration of the raptors begins during the first week of September. Most numerous are the Honey Buzzards *(Pernis apivorus)*, the Sparrowhawks *(Accipiter nisus)*, and the Spotted Eagles *(Aquila clanga* and *pomarina)*. These migrants fly very high and on a broad front.—Louise de K. Lawrence.

8. Weather Movements of Swifts 1955-1957. David Lack. 1958. *Bird Study*, **5** (3): 128-142. This paper brings up to date the author's studies on a subject that has long intrigued him and on which he has published a number of papers and one book. His observations on the Suffolk coast show "that nearly all southward movement of Swifts occurred with a depression centered over northern England or Scotland. The birds usually passed on a broad front during the day and were concentrated on the coast in the evening and early morning." He also amasses the mounting evidence—Swifts seen flying out to sea at dusk and returning at dawn, climbing in flocks skyward in the evening to disappear in the darkness—that suggests this species often, perhaps regularly, spends the night on the wing. He ventures that he "would not be surprised if further observations showed [this behavior] to be widespread in the family Apodidae."—O. L. Austin, Jr.

9. Experimental Influences on the 24-Hour Periodicity of Homing Pigeons and Their Effects with Special Reference to Homing Ability. (Experimentelle Einflussnahme auf die 24-Stunde Periodik bei Brieftauben und deren Auswirkungen unter Besondere Berücksichtigung des Heimfindevermögens.) Klaus Schmidt-Koenig. 1958. *Zeitschrift für Tierpsychologie*, **15** (3): 301-331. A contribution from Gustav Kramer's laboratory. The incubation relief schedule depends on the light-dark change and is upset by constant illumination as well as by 10-hour nights and 10-hour days. Under overcast conditions pigeons "are able

to localize the sun even when the human eye fails to do so." Results on homing under the experimental conditions are discussed in relation to recent hypotheses of orientation.—M. M. Nice.

10. Two Direction Experiments with Homing Pigeons: Long Distance Flights to North and South in West Germany. (Zwei-Richtungs-Versuche mit Brieftauben: Langstrecken-flüge auf der Nord-Süd-Achse in Westdeutschland.) J. G. Pratt and H. G. Wallraff. 1958. *Zeitschrift für Tierpsychologie*, **15** (3): 332-339. Homing pigeons without directional training were released singly near Giessen; 49 came from 185 miles to the south and 63 from 130-220 miles to the north. The latter homed more successfully than did the former, results that are consistent with previous experiments in the United States and Germany. Approximately 50 percent of the birds returned to their own lofts.—M. M. Nice.

11. On Spitsbergen and migrating Pink-footed Geese. (Problemer omkring Kortnebbgåsas trekk til og fra Spitsbergen *(Anser arv. brachyrhynchus)*.) Russell Webbe. 1958. *Sterna*, **3** (2): 41-52. (From the English summary.) Banding has proved that the Spitsbergen Pink-feet winter mostly on the south coast of the North Sea (cf. *Bird-Banding*, **29** (1): 48), but so far has failed to delineate satisfactorily the routes followed in either autumn or spring or the stopping places. The evidence for various possible routes is summarized.—O. L. Austin, Jr.

12. On observations of Pink-footed Geese in the Spring of 1955, 1956 and 1957 at Tipperne, West Jutland, Denmark. Hans Lind. 1958. *Sterna*, **3** (2): 53-57. Notes on the numbers, arrivals, departures, and behavior of the large flocks of Pink-feet that visit this Danish sanctuary every winter and spring. See also No. 11.—O. L. Austin, Jr.

13. On the first arrival of the Swift. (Zur Erstankunft des Mauerseglers.) Dr. Knoblaunch. 1958. *Ornithologische Mitteilungen*, **10**: 110-111. A review of records for the first arrival of the Swift *(Apus apus)* from 1896 to the present shows that there has been no change in arrival date during this period for places at the same latitude and elevation.—R. O. Bender.

14. Mass Mortality of migrant birds on the Island of Heligoland in April 1958. (Massensterben von Zugvögein im April 1958 auf der Insel Helgoland.) Gottfried Vauk. 1958. *Ornithologische Mitteilungen*, **10**: 181-3. Through a combination of circumstances, large numbers of migrant birds died of starvation in mid-April on Heligoland. Unusual numbers of finches and field larks wintering on the island had depleted the natural food supply, and unfavorable weather had delayed the normal emergence of insects. These two factors plus a very heavy influx of "weather migrants," principally starling and blackbirds from 17 to 21 April, combined to cause many of these migrants to starve. Weights of freshly dead starlings averaged 55.0 g. for males and 57.4 g. for females, compared with 76.0 g. and 76.9 g. for normal individuals. Body weights of 50-55 g. thus appear to be borderline for survival for this species.—R. O. Bender.

15. North American Birds Staying on Board Ship During Atlantic Crossing. R. MacArthur and P. Klopfer. 1958. *British Birds*, **51** (9): 358. Two White-throated Sparrows *(Zonotrichia albicollis)* crossed the Atlantic from New York City to Southampton from 27 September to 4 October 1957. They lived on crumbs. Three warblers were noted catching flies for 3 days, then disappeared.—M. M. Nice.

16. The Migration of the Curlew as shown by Belgian Banding. (Over de Trek van de Wulp, Numenius arquata (L.) volgens de Uitslagen van het Belgisch Ringwerk.) R. Verheyen. 1958. *Le Gerfaut*, **42** (2): 167-171. (From the French summary.) Fourteen recoveries of Curlews banded on their Belgian breeding grounds, whether as adults or young is not stated, show these birds move westward along the English Channel and winter southward along the Atlantic coast of France and Spain to southern Portugal. A reduction in the number of Curlews nesting in Belgium is attributed to the clearing, presumably for agriculture, of the Campine plains between Antwerp and the coast.—O. L. Austin, Jr.

POPULATION DYNAMICS
(See numbers 3, 23, 39)

NIDIFICATION AND REPRODUCTION
(See also numbers 31, 41)

17. The Breeding Biology of the Chimney Swift *Chaetura pelagica* (Linnaeus). Richard B. Fischer. 1958. *New York State Museum and Science Service Bulletin*, **368**: 1-141. Studies made from 1939 to 1953 in a village in New York state where the swifts were nesting in barns, 2 pairs in one case, single pairs in 6 others. Aluminum and colored bands were used. Of 40 adults marked at their nests, 25 (62.6 percent) returned, most of them to their former nest sites. Of the 92 birds banded as nestlings 10 (10.8 percent) were recaptured in following years; 8 of these bred in the area, 5 during the year after banding.

Chimney Swifts break twigs off with their feet, but carry them to the nest in their bills; here they stick them to the wall with saliva. Egg laying begins when the nest is about half built. Dr. Fischer describes for the first time copulation in this species; it occurred at the nest site during the egg laying period. Both parents incubate, the eggs hatching in 19 days. Post-embryonic development is also slow, the eyes of the nestling not opening until the 15th to 18th day. After that the nestlings crawl out on the surrounding wall but do not leave the close surroundings of home till 30 days of age; they return to roost with their parents for another week, but apparently are no longer fed.

"An adult fed the young at an average rate of once each half hour for the first week, about once every 45 minutes in the second week, and erratically after that." After the first week the parents brought pellets containing at times more than 200 insects. One pair had a helper, one of their offspring of the previous year; this bird fed the young more than did either of its parents.

This report contains descriptions of the techniques of the study, a 6½-page bibliography, a 1-page index and 23 excellent photographs. All in all, a real contribution to the life history of this interesting species.—M. M. Nice.

18. Nesting and Food Habits of the Long-eared Owl in Michigan. William H. Armstrong. 1958. *Publications of the Museum—Michigan State University; Biological Series*, **1** (2): 1-96. Two nesting pairs of *Asio otus* were watched. Incubation and brooding were performed by the females, both of which attacked the observer when their young were small. "The adults were observed to utter 23 different calls," the calls of the female being higher in pitch than those of the male. Young left the nest at about 25 to 26 days of age, but were not able to fly until 34 days of age. Mice constituted the major prey item in 2,079 pellets containing 3,263 items both in summer and winter. Incubation period is stated to have lasted "from 22 to 26 days." The first figure is certainly too short; 27 to 28 days were reported by Heinroth, Evans, and Sumner (see Nice, 1954, *Condor*, **56**: 183-4).—M. M. Nice.

19. Nesting of the Red-eyed Vireo in the Douglas Lake Region, Michigan. William E. Southern. 1958. *Jack-Pine Warbler*, **36** (3): 105-130; (4): 185-207. The author studied 26 nests of *Vireo olivaceus* during 3 seasons at the University of Michigan Biological Station; he spent 256 hours in blinds watching nests and 122 additional hours watching without blinds. Incubating females were marked by airplane dope on a color-soaked cord on the rim of the nest or sprayed with a squirt gun. Besides his own work he utilized the un-

published manuscripts on this species of 12 former students. Size of territories averaged 1.2 acres. The female alone built the nest, incubated the eggs, and brooded the young. Cowbird *(Molothrus ater)* parasitism was heavy, from 1 to 7 eggs being found in 69 vireo nests. Of 78 nests whose outcome was known 59 were parasitized. Nineteen nests were deserted and 11 destroyed by wind or predators, while 48 produced 76 vireos and 34 cowbirds. In 3 nests 2 vireos and 1 cowbird were raised; in 3, 1 vireo and 1 cowbird, and in 2, 1 vireo and 2 cowbirds. One pair of vireos raised 3 cowbirds—quite a feat.—M. M. Nice.

20. Photographic Studies of Some Less Familiar Birds. XCII. Little Shearwater. John Warham. 1958. *British Birds*, **51** (10): 393-397. *Puffinus assimilis* is a winter breeder on Eclipse Island about 35° S. 117° E. The bird "does not fly overland until nightfall, although there are no natural avian predators like the gulls which are supposed to be responsible for the nocturnal habits of Manx Shearwaters on the Welsh islands. . . . By the end of January a good many pairs are already remaining inside burrows by day, although egg-laying is at least 6 months ahead." The single egg is incubated by both parents who exchange places about every 2 days. Incubation lasts 52-58 days, fledging 70-75 days. Six excellent photographs illustrate the article.—M. M. Nice.

21. Studies on increasing the population density of Hole- and Free-Nesting Birds and nutritional research on Songbird Nestlings in an area infested with the Oak Leaf-roller east of Frankfurt am Main. (Versuche zur Steigerung der Siedlungsdichte höhlenund freibrütender Vogelarten und ernährungsbiologische Untersuchungen an Nestlingen einiger Singvogelarten in einem Schadgebiet des Eichenwicklers im Osten von Frankfurt am Main.) Sebastian Pfeifer and Dr. Werner Keil. 1958. *Biologische Abhandlungen*, Heft 15/16. Verlag Biologische Abhandlungen, Hambrug, 52 pp. The report covers a study conducted during the years 1952-56 in a 25 hectare (75 acre) plot of damp forest in which the principal trees were *Quercus rubor* and *Carpinus betulus* which had suffered from a severe infestation of the oak leaf-rollers *(Tortrix viridana L.)* for years. Population density data were accumulated during 1949-51 for comparative purposes. A control plot of 18 ha., separated from the test area by a neutral zone between 155 and 450 m. in width, was also studied to provide additional comparative data. Measures taken to increase population density consisted of providing 1060 nest boxes (42.4/ha.) having various sized entrances (950 were sized for Tits), 125 artificial "nest pockets" of twigs for free-nesting species, 4 watering places and several winter feeding houses. These measures increased the number of fledged broods from 158 (6.4/ha.) in 1951 to 1026 (41/ha.) in 1956.

Concurrently, the food of 7976 nestlings of 10 species was sampled by the neck-band method. The 34,315 food samples identified showed larvae, pupae, or adults of *Tortrix* to be the principal source of food for all 10 species. Examination of each food specimen for parasitization did not disclose any preferential use of parasitized individuals. Results for individual bird species are presented in tables and discussed in detail.

Biological insect control research directed toward increasing bird populations has received a lot of attention in Europe. I have been awaiting with keen interest some indication of whether increasing avian populations does indeed provide some measure of control of insect infestation. Unfortunately this study, which is one of the best to come to my attention, does not answer the question, although it would seem that the data available are sufficient to provide at least some indication of its effectiveness. It is hoped that subsequent studies and reports will provide at least tentative answers.—R. O. Bender.

22. Advances in our Knowledge of the Honey-guides. Herbert Friedmann. 1958. *Proceedings of the United States National Museum*, **108** (3404): 309-320. Additional data are given on egg laying of 2 species, on new host species for 4 species, and on a new mammalian symbiont, a genet (a kind of civet cat), which dug at a bees' nest while a Greater Honey-guide sat watching and calling. The "rustling" sound heard in display flights seems to be produced

by the wings and not by the tail. Honey-guides get no wax in their food while they grow to full size in their hosts' nests, but once they begin fending for themselves they eat wax avidly, not as a substitute for some other food but as an addition to their diet.—M. M. Nice.

23. The Breeding of the Greater Flamingo *Phoenicopterus ruber* at Lake Elmenteita, Kenya Colony. L. H. Brown, 1958. *Ibis*, **100** (3): 388-420. This is a fine comprehensive study made in 1956-57 of a tremendous colony of these interesting birds, some 10,000 pairs strong, on one of the largest (7½ square miles) and least salty of the shallow alkaline lakes in Kenya, East Africa. In describing the breeding cycle, the author gives detailed notes on display, nests, eggs, nestlings, and behavior of both adults and young. He also comments at some length on feeding habits and the need and use of fresh water. He estimates the colony requires about 8½ tons of food daily, obviously a major factor limiting the size of the colony. His notes on predation and other causes of mortality show why breeding success varied from 21 to 74 percent in the several colonies he studied.—O. L. Austin, Jr.

24. Reproductive Periods in Birds Near the Equator. Alden H. Miller. 1958. *Caldasia*, **8** (37): 295-300. This is a mid-season progress report on the experimental work the author has been conducting on a marked population of *Zonotrichia capensis* in the Colombian Andes, which promises to add greatly to our knowledge of sexual periodicity in birds and the factors that control it. He describes the problems he is investigating and his methods of study, which involve repeated examination by modern surgical techniques of the gonad development in a color-banded and aged population. Of his results to date he writes: "We know that young males five months of age become fully developed sexually and that females actually nest at this age . . . that some males at least can go through the entire process of rest and regain full testis size with a period of only 2 months, the rest time itself being only about one month. . . . I now think that some *Zonotrichias* are in breeding state at all times of the year but a majority of our birds rested for a short time in March. This may happen again in August or September in this population. If we are fortunate and our marked birds survive and continue to live about our station, we hope to have this and many more questions answered by next January."—O. L. Austin, Jr.

BEHAVIOR

(See also numbers 8, 17, 22, 23, 41, 51)

25. Social Behavior in Hearing and Deaf Bullfinches. (Soziale Verhaltensweisen bei hörenden und gehörlosen Dompfaffen *(Pyrrhula pyrrhula* L.).) R. Hüchtker and J. Schwartzkopf. 1958. *Experientia*, **14** (3): 106. A number of Bullfinches that had had their cochleas removed were kept in flight cages with normal Bullfinches. Sixteen deaf males and females sang for 1 to 2 years as much and as well as those that heard. With only one male and one female did the voices gradually change. Female Bullfinches dominate males. Deafness had no influence on peck-order. Two females colored with methylin blue were fought by the males but nevertheless came out as victors. Deafness did not disturb pair formation, nest building, egg fertilization, and incubating, but care of young did not succeed when one or both parents were deaf and could not hear the food calls of the nestlings. Five pairs of normal parents raised broods, but the other pairs fed the young so little they died at about 5 days.—M. M. Nice.

26. Behavior Studies on the Mallard. II. Experiments on the Release and Imprinting of Following and Flocking Responses. (Verhaltensstudien an der Stockente *(Anas platyrhynchos* L.) II. Versuche zur Auslösung und Prägung der Nachfolge- und Anschlussreaktion.) Uli Weidmann, 1958. *Zeitschrift für Tierpsychologie*, **15** (3): 277-300. Experiments on 50 Mallard

ducklings hatched in an incubator under cardboard boxes. Ducklings isolated for less than their first 50 hours would join other young but if isolation lasted longer the ducklings would flee or remain passive when approached. The author suggests that the same basic response is involved in following the parent and in joining other young birds.—M. M. Nice.

27. The Meaning of the Parental Warning Cry for Curlews and Other Limicoline Chicks. (Die Bedeutung des elterlichen Warnrufs für Brachvogel- und andere Limicolenkücken.) Otto von Frisch. 1958. *Zeitschrift für Tierpsychologie*, **15** (3): 381-382. Day old *Numenius arquata* may crouch at the parental warning cry, or they may look up, or they may seem to pay no attention. Yet the parental cry serves to alert the chicks; as soon as they see the enemy they crouch. They also respond with crouching to other sounds that are loud and of similar rhythm to the warning cry. Lapwing *(Vanellus vanellus)* and Redshank *(Tringa totanus)* parents start to cry as soon as they see an enemy, but the chicks do not respond until they also see it.—M. M. Nice.

28. The Behavioral, Ecological and Morphological Characteristics of Two Populations of the Alder Flycatcher, *Empidonax trailii* (Audubon). Robert Carrington Stein. 1958. *New York State Museum and Science Service, Bulletin* **371**: 1-63. Some Alder Flycatchers sing fee-bee-o, others fitz-bew. The former range across Canada and into northeastern United States, while the latter are found in the United States, especially west of the Allegheny Mountains. Both occur together from central New York state west to Wisconsin. Playing recordings of each song brought a hostile response from males that sang this song, but indifference to the other song. Differences between the 2 types were found in the shrubs preferred, in height of nest sites, in nest structure, in color and size of egg, in length of wing, tarsus, and bill, and in color of the back. The author believes that two species, rather than subspecies, are involved, but states that further research is needed in other areas of sympatry besides that of Ithaca, N. Y. —M. M. Nice

29. Ingenious technique of a Great Tit. (Ingéniosité technique d'une Mésange charbonnière.) Jean Droit. 1958. *Nos Oiseaux*, **24**: 195-196. This brief note illustrated by two drawings describes the maneuvers of a Great Tit *(Parus major)* to make more accessible a net containing suet suspended from the branch of a rose bush. The bird grasped the string suspending the suet with its beak and pulled it up, holding it with its feet at points progressively closer to the net until the string caught over a thorn. The net then was close enough to the branch, which was at an approximate 45° angle with the ground, so the bird could feed on the suet while perched. Shortly thereafter the thorn broke off. The bird then repeated the procedure until it could hold strands of the net in its feet and so feed from the branch.—R. O. Bender.

ECOLOGY
(See numbers 21, 30, 36, 37)

WILDLIFE MANAGEMENT
(See also numbers 21, 43, 44)

30. Is biological pest control of the Oak Leaf-roller and its injurious company possible? (Ist biologische Schädlingsbekämpfung des Eichenwicklers und seiner Schadgesellschaft möglich?) K. Ruppert and R. Langer. 1957. *Forsttechn. Inform.*, Nr. 5, 29-38 (1957). (From a review by W. Przygodda in *Ornithologische Mitteilungen*, **10**: 156-7.) After 4 years of study of the effect of increased avian populations in a mature oak forest near Frankfurt am Main, the authors could detect no effect on the oak leaf-roller population attributable to birds. They conclude that chemical control measures followed by biological control might be more successful and also suggest that increasing avian densities might be more effective in younger forests.—R. O. Bender.

31. Goldeneye nesting boxes. (Knipholkar.) T. Brander. 1958. *Vår Fågelvärld*, **17**: 241-247. Goldeneyes *(Bucephala clangula)* prefer boxes made similar to natural cavities over ordinary board boxes. The boxes should be excavated in stumps that are peeled or covered by light-colored bark so as to

show up the dark entrance hole. Dimensions: entrance diameter 4 to 4½ inches, inside diameter 7½ to 8¼ inches, distance from entrance to bottom 14½ to 18 inches. The height from the ground is not important but the hole must always face the water. Care should be taken to eliminate branches and other uneven objects below the box, against which the young might kill themselves when they leave the nest. At his lake in Finland, the author at first failed to attract the Goldeneyes to his nest-boxes until he came upon the idea of erecting two on a post driven through the ice into the bottom of the lake near the spot where the ducks usually alighted upon arrival in the spring. Instead of only resting and departing again as they had done before, the ducks now became interested in these boxes with their dark holes. In the course of excited investigations, the ducks began flying around the shores where they found and settled into the other boxes which they had hitherto not seen.—Louise de K. Lawrence.

PARASITES AND DISEASES
(See also number 14)

32. Disease in a Colony of Black-headed Gulls *Larus ridibundus*. A. R. Jennings and E. J. L. Soulsby. 1958. *Ibis*, **100** (3): 305-312. Pathological and parasitological study of chicks found freshly dead in a large British gullery showed no pathogenic organisms, but widespread infection with various helminth endoparasites. Death was determined in a large percentage of these birds to be due to "chilling." Some were so heavily parasitized that the parasites were considered directly responsible for death; in the others the authors believe the parasites were certainly a contributing factor. One adult gull was found suffering from aspergillosus, which is believed at times to occur in epidemic proportions. Studies were also made of web lesions, which the authors call "vesicular dermatitis of gulls." They were able to isolate "a viral agent responsible for the lesions on the web and probably for the death of the immature birds."—O. L. Austin, Jr.

PHYSIOLOGY AND PSYCHOLOGY
(See also numbers 14, 24)

33. Nasal Salt Secretion in the Humboldt Penquin. Knut Schmidt-Nielsen and W. J. L. Sladen. 1958. *Nature*, **181**: 1217-1219. A captive *Spheniscus humboldti* fed salt experimentally began within 10 minutes to secrete it in fluid from its nasal glands. "Approximately two-thirds of the experimental dose of salt fed to the birds had been eliminated through the nose in 4 hrs. . . . The quantitative role of the kidney in sodium and salt excretion in this particular experiment was perhaps one-tenth of that of the salt glands." The authors point out the obvious advantages to marine birds of "an extra-renal mechanism that can excrete highly concentrated salt solutions." This allows them to ingest sea water and invertebrate food of high salt content and still "achieve a net gain in water."—O. L. Austin, Jr.

MORPHOLOGY AND ANATOMY
(See also number 14, 24)

ZOOGEOGRAPHY
(See also numbers 6, 11, 15, 28, 41, 46, 47, 48, 49, 50)

34. Revision and Origin of the Arctic Avifauna. (Revision und Entstehung der Arktischen Vogelfauna.) Hans Johansen. 1956. *Acta Arctica*, fasc. 8:98 pp.; 1958. fasc. 9:131 pp. (English summaries.) The author divides the area he treats into "high-arctic" having July mean temperature below +5° C., and "low-arctic" having a "tundra climate" with July mean between +5° and +10°. The latter is divisible into a northern "typical lichen and moss tundra" and a southern milder "scrub tundra." He lists six categories of true arctic birds, then further subdivides according to longitudinal distribution plus ecological division into "true sea-birds" and "land- and shorebirds." Throughout, there is reasonable and logical discussion of the species, their distribution, and their "supposed origin" in relation to past and present geological and climatological events. The treatment is conservative, not highly speculative, and reflects

the author's years spent in Siberia and his familiarity with pertinent Eurasian and other literature. Just one example of the interesting material included is discussion of the probable effects of past events in determining the present migration routes of some of the geese.

Eighty species are considered to be "true arctic" birds, and another 35 (occurring as breeders elsewhere) breed more or less regularly in the arctic. The arctic bird fauna is young, and derived from both the Old and the New Worlds. There seem to be two main categories of adaptation: (1) to darkness and cold *(Gavia, Somateria, Rhodosthetia, Pagophila, Xema, Uria, Cepphus, Plotus, Nyctea, Plectrophenax)*, and (2) to migrating great distances *(Branta, Calidris, Arenaria, Phalaropus)*. Some migrants (example: *Sterna)* having arctic breeding populations show no endemicity. New species are being added during the present Interglacial Period (in *Phalacrocorax, Anas, Mergus, Falco, Haliaeetus, Corvus, Anthus,* etc.). Incidentally, the same classification of the arctic environment and some of the other material are available in more popularly-written form in *The Arctic Year* by Peter Freuchen and Finn Salomonsen. 1958. (See *Bird-Banding*, **29** (4): 265). The reader will soon discover that captions for certain maps in this book should be transposed.—R. S. Palmer.

35. Races and Populations of the Capercaillie. (Rassen und Populationen des Auerhuhns *(Tetrao urogallus).*) Hans Johansen. 1957. *Viltrevy* (Stockholm, Sweden), **1**: 233-266. There are two species of *Tetrao*, the smaller *(parvirostris)* occurring east of about 95° E. in Eurasia, the larger *(urogallus)* occurring from within part of the range of *parvirostris* west to Britain and Spain. The two probably hybridize, though *urogallus* is scarce within that part of the range of *parvirostris* where it occurs. Johansen recognizes 7 races of *urogallus*. Size variation in the species is rather slight, but color varies geographically in considerable degree in both sexes. There is geographical variation in extent of feathering of the feet. Regional populations in four of the subspecies have sufficient distinctness to warrant discussion under separate headings. The author also discusses the evolution and distribution in relation to interglacial and glacial periods. This detailed study differs from and supersedes the brief contribution to Boback 1952 "*Das Auerhuhn*" *(Die Neue Brehm Bucherei*, no. 86). Especially in view of the numerous recent papers or biology on the Capercaillie, this discussion of its evolution and variation is most welcome.—R. S. Palmer.

36. Birds of the Colville River, Northern Alaska. Brina Kessel and Tom J. Cade. 1958. *Biological Papers of the University of Alaska*, No. 2: 1-83. $1.00. This excellent report on 87 bird species of the "Arctic foothills province" north of the Brooks Range is based on three summer expeditions of Tom Cade and on published and unpublished records of other observers. It describes eleven habitat types; a table for each denotes the affinities of different species for it in relation to various biological activities and the amount of use—major, secondary, or minor. The annotated list gives data on the following subjects: distribution, abundance (including number of days seen by Dr. Cade in 1952), habitat, migration, breeding, behavior, food, and specimens.

In the habitat "Bluffs, Slides and Outcrops" a group of species were usually found nesting within 100-200 yards of one another; typically these consisted of 1 pair of Rough-legged Hawks *(Buteo lagopus)*, 1 pair of Peregrine Falcons *(Falco peregrinus)* occasionally replaced by a pair of Gyrfalcons *(F. rusticolus)* and usually 3-6 pairs of Canada Geese *(Branta canadensis)*. "The rough-legged hawk seems to be the key species for many of these groups." It apparently returns each year to the same bluff, but oftens builds a new nest. "These old nests are much used by peregrines, gyrfalcons, and geese." The geese seem to be left alone by the raptors and must gain protection from the attacks of the peregrines on gulls, jaegers, ravens, and foxes.

This is an admirable bulletin, based on careful, expert field work and excellently planned to give a clear picture of the birds and their arctic habitats.—M. M. Nice.

37. An Ecological Sketch of the Camargue. L. Hoffmann. 1958. *British Birds*, **51** (9): 321-350. A careful, detailed study of this remarkable area in the delta of the Rhone with descriptions of the physical nature of the different habitats and their plants and animals. The illustrations of habitats and

birds are excellent. "Today salt is the dominant influence in the Camargue." Agricultural reclamation is modifying the Camargue, largely by bringing in much fresh water in connection with irrigating rice fields. There is also danger from the extension of the salt pans, which will harm the wintering ducks as well as some of the nesting terns and waders. "The Camargue is thus a landscape undergoing profound transformation, and its protectors have a very heavy responsibility. Will they succeed in conserving its treasures or must we face the successive losses of some of its most interesting species?"—M. M. Nice.

38. Population and Breeding Environment of the St. Kilda and Fair Isle Wrens. Kenneth Williamson. 1958. *British Birds*, **51** (10): 369-393. A detailed study of ecological preferences of *Troglodytes t. hirtensis* and *T. t. fridariensis*, based on censuses of dawn-singing males in the spring of 1957. The former, on St. Kilda, apparently reached 230 pairs, some in the deserted Village, but most on the cliffs, associated "with colonies of the Puffin *(Fratercula arctica)*, where there is abundant shelter and the main food is probably scatophagous and other terrestrial insects largely dependent on animal remains." "The Fair Isle population did not exceed 50 pairs in 1957, confined to the coast." Here they live in narrow inlets and subsist upon "small marine organisms and the larvae of seaweed flies." The author suggests that "in *fridariensis* adaptations to a more specialized food-spectrum may have carried this race beyond the point where re-colonization of the ancestral 'garden' habitat of the fertile crofting area is possible."—M. M. Nice.

39. The movements of Alpine Choughs (Pyrrhocorax graculus) wintering at Bulle (Fribourg). (Les déplacements des Chocards à bee jaune hôtes d'hiver de Bulle (Fribourg).) Jean Strahm. 1958. *Nos Oiseaux*, **24**: 177-184. This alpine crow frequents villages in winter and is seldom seen outside one. Furthermore, the winter flock is usually confined to a single village in a valley. The author studied the daily movements of one flock and particularly its nocturnal roosting during the winters of 1951-1957 in the village of Bulle in the Fribourg Prealpes of Switzerland. He found that the Bulle flock always arrived in the morning, approximately 30 minutes after daybreak, coming from the same direction and flying very low. At approximately 1430, the flock assembled and departed for its nocturnal roost. The departure hour did not change appreciably from January to April and was surprisingly independent of weather. The birds roost at night in rock faults and fissures, where they also nest in summer, at high altitudes, ca. 2000 m. The Bulle flock numbers about 200 in December and increases to 300-350 later in the winter. It has remained quite constant from year to year. Adults outnumber juveniles.—R. O. Bender.

40. Some Records of Australian Birds in New Zealand, 1957. R. A. Falla. 1958. *Notornis*, 8 (2): 29-32. Occurrence "in considerable numbers" in New Zealand of four Australian species (Coot, Little Egret, White and Glossy Ibises) suggests the importance of such vagrants in expanding the species' ranges.—O. L. Austin, Jr.

SYSTEMATICS
(See also numbers 28, 35, 47, 49)

41. Comparative Biosystematics and Life History of the Nuthatches *Sitta pygmaea* and *Sitta pusilla*. Robert A. Norris. 1958. *University of California Publications in Zoölogy*, **56** (2): 119-300. The Pygmy Nuthatch lives in pine forests in western North America, the Brown-headed in pine forests in southeastern United States. It has been suggested that both belong to one species. In an effort to settle this question, Dr. Norris studied *S. pygmaea* in California during parts of 4 consecutive years, and *S. pusilla* in Georgia in the summer and spring during 2 years. The birds were trapped and banded with aluminum and colored rings. "The systematic study involved the examination of 2,075 skins and 64 skeletons." Fifty-eight pages are devoted to a meticulous analysis of systematics and skeletal features and 123 to life history.

Sex ratios appear to be strongly unbalanced in favor of the males. Specimens (outside of the breeding season) of Pygmies showed 175 males:100 females; of the Brown-heads 152 males:100 females. Of 36 Pygmy nests 8 (22%) were

attended by an extra bird, and this was true of 3 (18%) of the 17 Brown-headed nests. In every case the helper was a male. He was not mated to the female, but "invariably assisted in nest construction, in feeding the nestlings, and cleaning the nest." He also helped feed the fledglings and in case of the Pygmies, roosted in the nest cavity with the parents.

The life history of the two nuthatches is reported in much detail. Under each subject observations are given on Pygmies, then on Brown-heads. Many "Comparative Summaries" are presented itemizing first similarities, then dissimilarities; these clearly show the great amount of information gained from close observation. Valuable data are given on incubation patches in females and its occurrence according to dates and corresponding size of ovary and oviduct. Curiously enough, 3 mated female Brown-heads "neither bred nor seriously attempted to breed." One developed an incubation patch, one showed a very limited amount of defeathering, while in the third there was no trace of such a patch. With Pygmies incubation lasted 15½ to 16 days, fledging 20 to 22 days, post-fledging care for 3 or 4 more weeks. With Brown-heads incubation lasted about 14 days, fledging 18 to 20 days, post-fledging care some 3½ weeks. The females incubate and brood; the males feed the females, and both feed the young. Pairs are permanently mated and their young stay with them throughout their first year. A very interesting section is devoted to survival and longevity.

The last two pages of the text are devoted to "The Species Question: Summary and Conclusions." Here the author briefly covers the chief differences between the two species in plumage color, tail/wing ratios, skull measurements, call notes, height of nests, nest materials, size of sets, incubation rhythm, parasites, breeding seasons, roosting habits, territory sizes, etc. Thus from "morphologic, ecologic, and ethologic" findings Dr. Norris feels confident of the specific distinctness of these nuthatches. A notable contribution.—M. M. Nice.

42. Classification and Systematic Position of the Eiders. Philip S. Humphrey. 1958. *Condor*, **60** (2): 129-135. The tracheas and tracheal bullae of the eiders are similar to those of the dabbling ducks of the tribe Anatini of Delacour and Mayr (1945). The food habits of the eiders on the breeding grounds and the plumage patterns of the females and downy young lend support to their removal from the sea duck tribe, Mergini, and their placement in a separate tribe, Somateriini, near the Anatini. Delacour (1956) and Ripley (1957) have previously mentioned these affinities. Delacour and Mayr consider all four species of eiders congeneric. Humphrey agrees that *Lampronetta* is not generically distinct from the two species of Somateria, but feels the genus *Polysticta* should be retained because of differences in the tracheal bulla, adult plumage patterns, skeletal proportions and structure of the bill. The flight of *Polysticta* also differs from that of the other eiders.—Glen E. Woolfenden.

EVOLUTION
(See numbers 34, 35)

FOOD
(See also numbers 17, 18, 21, 22, 23, 30, 38)

43. Food of Young Black-billed Gulls *(Larus bulleri)* in a Breeding Colony, North Canterbury. Elliott W. Dawson. 1958. *Notornis*, **8** (2): 32-38. While banding young gulls the author collected 23 samples of food regurgitated by the chicks or dropped at the nests by the parent birds. These consisted of 43 percent insects, 23 percent earthworms, 20 percent fish, 7 percent crustaceans, and 3 percent of molluscs and plant materials. On this foundation he builds a fine, stirring essay condemning the unjust persecution gulls and other "predators" are subject to in New Zealand from "trigger-happy" sportsmen, and pointing out the need for public education in conservation as well as for more adequate protection for the birds.—O. L. Austin, Jr.

44. Pellets of the Tawny Owl *(Strix aluco)* from the Westerwald and of the Barn Owl *(Tyto alba)* from Bonn. (Gewölle von Waldkäuzen aus dem Westerwald und von Schleiereulen aus Bonn.) Rudolf Heim. 1958. *Ornithologische Mitteilungen*, **10**: 141-7. The list of prey species obtained in pellets collected from 1954 to 1958 does not differ in any important respect from

previously reported lists from the same species and areas. It was found that the Barn Owl caught a high proportion of female microtinae and, hence, constitutes a more important control factor on these mice than the simple proportion of their occurrence to that of other prey species would indicate.—R. O. Bender.

SONG

(See also number 27)

45. The Relation of Bird Song to Music. Charles Hartshorne. 1958. *Ibis* **100** (3): 421-443. "Bird song is considered as a primitive form of music, and as an evolutionary anticipation of human music. Evidence is seen in the use of elementary musical devices: in the avoidance of mechanical regularity (principle of the "monotony threshold"): in the learning of songs and tunes: in the partial detachment from utility, and the playful cultivation of sound production; and, finally, in the tendency of species with more elaborate and, by our criteria, more "musical" songs to spend a larger fraction of the minute, day, and year singing (the "correlation of quantity with quality"). The best singers are those with more variety and complexity in the use of elementary musical devices." Good bibliography of some 60 titles for those who want to delve more deeply into the aesthetic, phychological, and behavioristic aspects of this highly argumentative subject.—O. L. Austin, Jr.

BOOKS AND MONOGRAPHS

46. Picture Book of Birds. (Chorui no Zukan.) H. Takahashi and Nagahisa Kuroda. 1957. Picture Book Series for Children No. 4, Shogakkan Printers, Tokyo, Japan. 127 pages. Price 380 yen. I believe this excellent book may well have been written because the junior author could not find a suitable and adequate guide to the identification and study of birds to give his own young son. I remember most distinctly when this little boy was born, before we left Japan 9 years ago, and he is just about the right age now to start reading the book his father has co-authored. What is more important, he can not only understand it today, he can continue to use it as a field and study guide almost indefinitely, and it will be a long while before he outgrows it. Though it presents the subject very simply, it is far more comprehensive, detailed, accurate, and interesting than many western bird books that are not labeled "for children."

From his father's book this very young Kuroda, who has a family history of men of science back to medieval times, can learn much of the accumulated knowledge of birds of both east and west. The 60 plates in full color (by the leading bird artists of Japan—Kobayashi, Okamura, Matsuura, Ando, Kojima, and Yamashita) show practically all the birds of Japan against their proper backgrounds, with the nests and eggs of those that breed there, and with marginal notes on field marks, songs, habits, and distribution. Also included are several pages of domestic fowl, the commoner cage birds, and the more striking of birds to be seen in zoos. Another 15 plates in two colors picture representative birds of the rest of the world, Europe, North and South America, the tropics, the oceans, the antarctic, even one page of extinct birds. Here also are a series of drawings illustrating some quite advanced avian biology, showing how birds are put together (skeletons, muscles, internal organs, types of feet and bills), how they reproduce (courtship and display, nest structure, development of the embyro), how they escape their enemies (protective coloring and mimicry), how different birds fly (diagrams of flapping, soaring, and gliding flight), and how diving birds dive and swimming birds swim. The 50 pages of text, interspersed with the simple line drawings, diagrams, and maps at which the Japanese excel, describe birds through the seasons in Japan, their migrations, and the life-zones they inhabit. There are chapters on food habits and ecology, on bird protection and game laws, on methods of studying birds, with notes on blinds, taxidermy, and the care and storage of museum specimens. Finally there is a simple natural classification with common (not scientific) names, which shows the young reader how birds fall into natural orders and families.

The scientific accuracy and comprehensive coverage are those usually found in a book for adults. Yet the material is presented with simple clarity. I just hope someone does the same sort of thing in English for the boys and girls and birds of the United States before my unborn grandchildren are ready to start learning about birds. As with this book, I would like it to be written by

our top ornithologists, illustrated by our best bird artists, well produced and bound, and published with the same altruism that makes it possible to sell this one for the equivalent of $1.10, thus putting it within the reach of every child.—Elizabeth S. Austin.

47. A Hand-List of the Japanese Birds. Fourth and Revised Edition. Edited by a special committee of the Ornithological Society of Japan. 1958. Tokyo, Japan. 264 pp. No one is more acutely aware than am I of the difficulties faced and overcome by Japanese ornithologists during and subsequent to World War II. This volume, slated originally for publication on the Society's 40th anniversary in 1952, has been delayed continually by a series of mishaps, both economic and political, and it has suffered accordingly. It is not, I am sorry to say, a worthy successor to its three predecessors. It shows signs of disagreement among the committee that edited it (no less than 38 conferences since it was first drafted in 1950) in both taxonomic questions and the validity of the evidence at its disposal. Finally printed under government subsidy, the need of meeting official deadlines despite printing delays allowed an inexcusable number of typographical errors to remain uncorrected, so many in fact that by itself the volume is almost unusable. Most of all it misses the fine editorial hand and expert knowledge of English idiom of the late Masauji Hachisuka. I hope that a fifth and thoroughly revised and corrected edition is now in progress for appearance on schedule on the Society's 50th anniversary in 1962. It will be most welcome, and most useful.—O. L. Austin, Jr.

48. A History of New Hampshire Game and Furbearers. Helenette Silver. 1957. New Hampshire Fish and Game Department, Concord, New Hampshire, Survey Report No. 6, xiv + 466 pp., 34 tables, 21 figs. Price $2.80. New Hampshire is minute in its area, which is less than that of a 100-mile square, but huge in its history. This volume covers a span of some 350 years, and the 12-page bibliography confirms the author's statement that the research involved in preparing it was enormous. Presented largely in narrative style, but bolstered with many tables of game statistics and detailed records (mostly of recent origin), the approach is that of the historian rather than the scientist.

Ornithologists must censure severely such lapses as the recognition of *Anas rubripes tristis*, which the A.O.U. Check-List Committee dropped in 1945, and the utter lack of systematic order in the listing of species. Thus in the Waterfowl section ducks precede geese, the Mallard is the 18th species to follow the Black Duck, the Lesser Scaup comes 17th after the Greater Scaup, Barrow's Golden-eye is fourth after the Common (American) Golden-eye. How the King Eider happens correctly to follow the Common (American) Eider is a mystery. The sequences in other bird groups and in the mammals is similarly confused and follows no apparent plan, alphabetical or otherwise, unless possibly that of an assumed order of relative abundance or of local interest. However, few of the readers for whom the book is primarily intended either know or care about phylogenetic sequences, and the procedure detracts but little, other than to force all readers to consult the List of Contents to find a given species easily.

Part 1, General History, describes the early use of the land and forests by the Indians and their methods of game control. It shows how the improved methods of hunting, lumbering, and agriculture brought by the immigrants affected game populations, and traces the development of man's efforts to maintain them to the present day. Long after the state came into existence the Fish and Game Department was organized, and introduced hunting licenses and revenues, law enforcement, payment of damages for crop destruction by game, and bounties (in 1955 bounties were paid for 449 bears!). Other sections discuss Refuges, Sanctuaries and Management Areas, and Research. Part 2, Mammals, traces the known histories of Big Game, Furbearers, Predators, and Small Game. Part 3, Birds, treats of Upland Game, Shore Birds, Waterfowl, and Doves and Pigeons. The Appendix covers a variety of subjects from forest fires and unusual weather to the Pittman-Robertson Projects of which this is the final report under W9-R. The volume merits commendation for the wealth of useful information it has collected and presents so informatively. It establishes a precedent which, it is hoped, other larger states will follow.—Wendell Taber.

49. Birds of the Ungava Peninsula. Francis Harper. 1958. *Miscellaneous Publications* No. 17, Univ. of Kansas Mus. of Nat. Hist., pp. 1-171, 6 pls,

26 figs. This is essentially a report of the author's field experiences in central Ungava and along the north shore of the Gulf of St. Lawrence in 1953. To this he has added a great deal of hitherto unpublished information, much of it from nonornithological sources, and he has culled worthwhile bird data from several early and little known publications overlooked by previous compilers, including myself. As we have learned to expect from its author, the book is well written, minutely proofed and double-checked, and contains much excellent ornithology, especially Harper's personal observations and comments on behavior, nesting, and song.

Despite the work's over-all competence and professional polish, several flaws merit comment. The first is the title, which the author admits is inaccurate. It belongs more appropriately to the far more comprehensive study that W. E. Clyde Todd has been working on for the past 57 years and which, we expect, is at last soon to see print. A title, as well as being brief, should reflect as accurately as possible the contents of a scientific book, and this one's broad scope is not warranted by the volume's coverage. Though Harper cites distributional references from the literature for parts of the peninsula he has not visited, he makes no effort to list all species recorded from the region, but includes only those on which he "made personal observations or . . . secured information from sources other than the published literature." This leaves many gaps, even for the part of the peninsula he did visit. As well as being more fitting, the title "Birds of Central and Southern Ungava" would not have imposed unduly on bibliographers.

Also confusing in a general work of this sort is Harper's refusal to accept the judgment of his peers in such matters, among others, as Bartramian names *(Phalacrocorax floridanus, Strix acclamator, Lucar carolinensis)*, the line-priority squabble over *linaria* versus *flammea* in *Acanthis*, and the *leucophrys-gambelii-nigrilora* problem in *Zonotrichia*. His published views on these questions have been reviewed and rejected by majority opinions of as competent authority as exists. While I grant him every right to dissent and to use any nomenclature he deems prudent, his reiteration of these discarded names without further evidence to support them in no way helps to validate them. On the contrary, such mumpsimusness only delays nomenclatural stability and detracts from the book's usefulness by confusing the general reader.

Lastly I question the reliability with which Harper invests sight records, not only his own, but those of less capable and trustworthy observers. An outstanding example is his carefully detailed report of seeing a Lark Bunting (p. 139) at Seven Islands. I cannot understand why he apparently made no attempt to collect this possible first record for Quebec which, without specimen verification, must by all conservative standards remain on the hypothetical list. Other species he admits on the basis of sight identification, often by nonornithologists, include Great Blue Heron, Coot, Sparrow Hawk, Pileated Woodpecker, Mourning Dove, Bluebird, Catbird, and Evening Grosbeak. Even less sound is his recognition of subspecies without collecting and comparing specimen material. He may be able to identify subspecies at sight in the field, as he claims for the nominate race of the Robin (p. 105), but I for one would not so commit myself in print. Despite the lack of specimen evidence in a number of still moot cases, the only polytypic species he does not list trinomially is the Flicker. This he records binomially ostensibly to emphasize his objection to the ranges of *C.a.luteus* and *C.a.borealis* as given in the 5th Edition A.O.U. Check-list, which he condemns as being (p. 29) "an acceptable guide in most but not all cases." He further shows his disapproval of it by retaining the common names of the 4th edition, including those for subspecies. It is always healthy for a democracy such as ours to have an articulate unreconstructed minority.—O. L. Austin, Jr.

50. Georgia Birds. Thomas D. Burleigh. 1958. University of Oklahoma Press, Norman, Oklahoma. XXIX—746 pp. and 35 paintings by G. M. Sutton. Price $9.95. The long awaited definitive volume on the birds of Georgia is worth the wait. Burleigh's efforts have produced a book that stands close scrutiny and remains in company with Howell's "Birds of Florida," Todd's "Birds of Western Pennsylvania," Roberts' "Birds of Minnesota," and Eaton's "Birds of New York." It presents each bird in a standard format with an outline

of "General Distribution," a discussion of "Status in Georgia," and information on "Habits and Recognition." The order and names used are those of the 1931 Check-List and its supplements through 1956. Burleigh did find it to his liking to introduce a few new vernacular names for newly recognized subspecies. Such resulting mouthfuls as "Red-eyed Rufous-sided Towhee" bid fair to take their place alongside the "One-eyed One-horned Flying Purple People-eater." Perhaps both will move into limbo together.

Welcome additions to the volume are George Sutton's short history of his studies and planning for the color plates, W. W. Griffin's interesting chapter on the history of ornithology in Georgia, and Robert A. Norris' very worthwhile discussion of the physiographic regions of Georgia, prepared with special reference to the distribution of the breeding birds. While Norris' figure showing *two* systems of regional classification superimposed is so complex as to be almost undecipherable, his treatment is otherwise masterful and contains a wealth of information.

The 35 color plates do not appear to have been reproduced with uniform attention to quality in the copy I have at hand, but the great majority are very pleasing to the eye. I am personally pleased by the attention Sutton gave to furnishing identification of the plants in his paintings. Where this was done it adds considerably to an understanding of the natural history of the bird portrayed.

The author and his collaborators are to be congratulated on having made a new model available for prospective authors of state bird books.—J. C. Dickinson, Jr.

51. Curious Naturalists. Niko Tinbergen. 1958. Country Life Limited, London. 280 pp. 35s. In this delightful book Dr. Tinbergen describes without technical language some of the projects of himself and his students in watching living things in their natural surroundings and in carrying out well planned experiments. In engaging, simple narrative he tells of his first enterprise—the study of the digger wasp or bee-wolf, of the year spent with his wife in Greenland, and of many problems worked out on birds and insects. He vividly expresses the effect on the observer of color-marking his subjects: "It was remarkable how this simple trick of marking my wasps changed my whole attitude to them. From members of the species *Philanthus triangulum* they were transformed into personal acquaintances, whose lives from that very moment became affairs of the most personal interest and concern to me."

The six chapters devoted primarily to birds describe Snow Buntings, Phalaropes, Hobbies, Kittiwakes, Black-headed Gulls, and Eiders. The eight that deal largely with insects discuss "locality studies" of sand and digger wasps on their nests, camouflage and its effectiveness against birds, the frightening effect on birds of eye-spots on wings of butterflies and moths, and many other subjects. These problems studied with "care and love" give us clear pictures of the interdependence of different forms of life. The author tells us: "I feel the principal gain I have had from my studies is the growing awareness of the huge variety of animal life, the endless diversity of life patterns, of ways of coping with an adverse world; all helping to come out of the battle victorious."

The strenuous and happy field work "has always been fun." It is fun to read about it, an enlightening experience and an inspiration.—M. M. Nice.

NOTES AND NEWS

In keeping with our custom of the past three years, the July, 1959 issue will emphasize studies on migration, and the use of mist nets. It will include a paper on visible migration at Narragansett Bay, R. I., by Baird and Nisbet. We also hope to publish some of the results of the coastwise netting project (Operation Recovery) from the fall of 1958.

Those interested in participating in Operation Recovery for the first time can get details from James Baird, Norman Bird Sanctuary, Third Beach Road, Middletown, R. I. We expect another very active season, including some netting on Cape Cod at the Wellfleet Bay Wildlife Sanctuary of the Mass. Audubon Society (the former Austin Ornithological Research Station property).

Our stock of back issues of *Bird-Banding* has been replenished by a number of gifts, particularly from Oliver L. Austin, Jr. A new list showing issues available may be obtained from Mr. Harlow. If any reader is discarding issues prior to 1949, and cares to give them to the Association, Mr. Harlow would welcome them.

Val Nolan, Jr. (1708 N. Fee Lane, Bloomington, Ind.) is interested in purchasing a complete set of *Bird-Banding* in good condition.

The ornithological library of the late Arthur Cleveland Bent has been presented to the University of Massachusetts, as a memorial, by Mrs. Bent.

The Fish and Wildlife Service is asking banders along the east coast to band at least 10 *nestlings* apiece of the Redwinged Blackbird during 1959. Banding individuals once they have left the nest is of some help in their studies of damage to crops by this species. However, in the past very few birds have been banded in the nest. Only these nestlings can tell us definitely just where the birds damaging crops were reared, and thus from what area the flocks gathered in the grain fields. Here is a real opportunity for most banders to contribute to a cooperative study, without great effort on their part. Details may be obtained from Mr. Brooke Meanley, Patuxent Research Refuge, Laurel, Md.

NEBBA FINANCIAL STATEMENTS, 1958

The various financial statements for the Northeastern Bird-Banding Association for the fiscal year ending October 31, 1958 reflect its increasingly varied activities.

Mr. Harlow has instituted a double-entry bookkeeping system for our general accounts, and made some other changes, which are designed to show somewhat more details, and to separate various funds more specifically, than in the past. The 1957 and 1958 figures are not strictly comparable, as the 1958 figures tend to overstate the operating loss slightly, to understate the net worth slightly, and to understate amounts in separate funds by a somewhat larger amount.

The expenses shown in the general statement for printing reflect longer issues than in past years; the increase in printing rates (the first since 1951) accounts for about $380 of this sum, on three issues (we show costs of the four issues for which bills are received during the fiscal year—October, 1957, and January through July, 1958). We hope that a continuation of our present rate of growth in paid circulation will narrow the gap between income and expenses for the 1959 fiscal year.

As of October 31, 1958, we had spent $299.60 on preparation of the ten-year index for 1941-50. The expenses incurred during the 1958 fiscal year are shown under the subheading for the Index Fund, but not in the general list of expenses (income for the Index Fund will be treated similarly). The first draft of the typescript for the index has been completed, and a satisfactory quotation received for preparation by photo-offset, so that the volume may be ready by the end of 1959.

The statement for our new Nantucket Ornithological Research Station Fund shows a substantial carryover, as the active season in 1958 was shorter than that contemplated in 1959 and 1960. The practice of appointing an Assistant Treasurer to handle a sizeable separate fund like this relieves the heavy burdens of the Treasurer. Such Assistant Treasurers do not become members of the NEBBA Council *ex officio*, but may be members if elected in the usual way, as John H. Conkey was at the last annual meeting.

The Mist Net Account had another active year, despite the imposition of U. S. customs duties which made it necessary to increase the price of nets. From March 20, 1958 to date, our standard net (type A) was never out of stock, and we hope to keep it in stock continuously during the current year as well, so that orders can be filled immediately. The greater part of the "miscellaneous" expenses represent reprints of Seth Low's paper on the use of mist nets (*Bird-Banding*, **28**: 115-128). These reprints are being distributed without charge, to stimulate interest in the use of nets and to help users of nets to master the special techniques necessary.

The number of types of nets in stock increased to four, including type D, which is 6 meters long (like type B) but 4 shelves high (like type A). We also have a few experimental shorebird nets, like type C but undyed (white) instead of black. It has been suggested that these may work better than a black net for daytime use on a white beach, or that they should be dyed to match a brownish background; but these theories have not yet been confirmed. For prices and other details on nets in stock, please write to E. Alexander Bergstrom, 37 Old Brook Road, West Hartford 7, Conn.

GENERAL FINANCIAL STATEMENT — 1958

PROFIT AND LOSS SHEET

RECEIPTS

	1957	1958
Subscriptions and dues	$2,434.43	$2,508.00
Sales of back issues	154.00	72.75
Other Income (donations, etc.)	200.75	100.00
Interest	80.46	66.75
Total	$2,869.64	$2,747.70

EXPENSES

Printing of *Bird-Banding*	$1,961.55	$2,762.07
Other printing and stationery	71.20	396.91
Postage and clerical	204.25	
Bank charges	.54	.72
Index clerical	150.00	
Miscellaneous	24.00	10.00
Total	$2,411.54	$3,169.70
Net operating profit, 1957	508.10	
Net operating loss, 1958		451.42

BALANCE SHEET

ASSETS

Cash	$4,619.08	$4,174.18
Back issues of *Bird-Banding*	1.00	1.00
Accounts receivable		36.00
Total	$4,620.08	$4,211.18

LIABILITIES AND NET WORTH

Reserve for October *Bird-Banding*	$ 507.81	$ 537.23
Subscriptions paid in advance	20.30	58.00
Index Fund	1,450.00	1,300.40
Life Membership Fund	375.00	500.00
Net worth	2,266.97	1,815.55

INDEX FUND REPORT

Accumulated 1957	$1,450.00
Expenses 1958	149.60
Net Reserve 1958	1,300.40

LIFE MEMBERSHIP FUND REPORT

Accumulated 1957	375.00
Additions 1958	125.00
Net Reserve 1958	500.00

HUGH E. HARLOW, Treasurer

MIST NET ACCOUNT — 1958

PROFIT AND LOSS SHEET

RECEIPTS

	1957	1958
Sale of nets	$2,112.36	$2,392.93
Gifts	30.00	—
Total	$2,142.36	$2,392.93
EXPENSES		
Cost of nets (and incidental expenses)	$2,254.11	
Cost of nets, postage, customs		$2,475.52
Miscellaneous		86.23
Paid on loans	180.00	257.45
Total	$2,434.11	$2,819.20
Net operating profit	397.40	365.62

BALANCE SHEET

ASSETS		
Cash	$ 306.14	$ 327.87
Accounts receivable	43.25	178.61
Nets on hand (at cost to date)	4.50	633.23
Nets on order (at cost to date)	1,217.50	402.50
Other	2.40	7.00
Total	$1,573.79	$1,549.21
LIABILITIES		
Nets paid in advance	$ 147.50	$ 14.75
Loans	557.45	300.00
Reserve for contingencies	200.00	300.00
Surplus	668.84	934.46
Total	$1,573.79	$1,549.21

E. ALEXANDER BERGSTROM, Assistant Treasurer

NANTUCKET ORNITHOLOGICAL RESEARCH STATION — 1958

RECEIPTS

Donation	$5,000.00
Net Account (transmittal for insurance)	19.50
Federal Income Tax withheld	153.40
Social Security Tax withheld	38.94
Total	$5,211.84

EXPENSES

Salaries	$1,730.00
Travel expense	300.00
Income Tax withheld	153.40
Social Security Tax	77.88
Insurance	92.30
Printing	42.96
Bank charge	.69
Miscellaneous	25.00
Balance forward	2,789.61
Total	$5,211.84

JOHN H. CONKEY, Assistant Treasurer

BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

Published quarterly for:

THE NORTHEASTERN BIRD-BANDING ASSOCIATION
THE EASTERN BIRD-BANDING ASSOCIATION
THE INLAND BIRD-BANDING ASSOCIATION

Applications for membership in these associations should be sent to their respective secretaries. The annual membership dues of $5 per year ($7 family membership, for adults) in the Northeastern Association include a subscription to *Bird-Banding*. Membership in the Eastern and Inland Associations is $2 each per year; members of those associations who wish to receive *Bird-Banding* may send $4 direct to the secretary-treasurer. Subscription price to non-members of the associations is $5 per year; single copy $1.25.

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